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JOURNAL *of* EDUCATIONAL RESEARCH

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ANALYSIS OF THE TASK OF LEARNING TO READ

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MANY teachers of reading do not have a clear idea of what is to be accomplished by learners of this subject, or the goal to be attained. The learners, on the other hand, cannot be expected without assistance to know either what is to be achieved or what they must do to achieve it. This being the case, neither teachers nor learners are in a position to know what is to be achieved or how each of the several tasks of learning can best be performed. It is the purpose of this paper to list and describe the specific problems which learners of reading must solve in order to learn to read.

When these problems are definitely known, steps may then be taken to ascertain how each of these can best be done, how the learners' progress in doing them may be measured, and how difficulties in performing them may be avoided, or successfully overcome. A complete analysis of the problem of learning to read would give definite help on many problems pertaining to the mastery of reading. We shall, in this paper, merely attempt to make clear the goal which all learners of this subject should seek to attain and to describe the more important problems which pupils must solve while learning to read.

END TO BE ATTAINED IN LEARNING TO READ

Learning to read presents three groups of problems which might well be called stages in the process of learning to read, namely: (1) learning to recognize the standardized written and printed symbols of the language and to comprehend what they mean; (2) interpreting, digesting, and evaluating the author's meaning after it has been apprehended; (3) getting these facts from the printed page in such a way that they can and will be used in the learner's future study and work.

1. *Comprehending the author's meaning* presupposes that the reader has acquired two different abilities: (1) the ability to perceive accurately and quickly the written and printed symbols used to convey the

meaning locked up in the words on the page; (2) the ability to obtain the exact meaning which the symbols stand for or represent. Each of these abilities must be acquired by all learners of this subject. The acquisition involves, therefore, a form of perceptual learning where the things observed are standardized language symbols instead of actual events. In fact, this form of perception must be learned so well that the symbols, as such, disappear completely from the reader's mind, serving the same purpose for him that a window does for an observer who is trying to survey the landscape on the outside. The accurate and ready recognition of the standardized symbols which convey the author's meaning, and the accurate reproduction of this meaning in the reader's mind, is the end to be attained in the first stage of learning to read.

2. There is, however, a second stage to the problem of learning to read. To read in the proper way one must reflect upon the significance of the thought which the author has expressed. The reader should relate it to what he already knows and view it in the light of his experience. He should judge and evaluate it *after* he is sure that he understands what the author has said. Merely apprehending what has been said is not enough. This should, of course, be accurately done first of all, but a good reader does not stop there. He reflects upon the thought that has been conveyed by means of the printed page. He considers the *significance* of what has been said even before he tries to fix it in mind for future use. *Interpreting the ideas gotten from the printed page and evaluating them in the light of the reader's own experience* may, therefore, be said to be the goal of the learner in the second stage of learning to read.

Real reading means striving to understand; it means finding the essence of the paragraph or of the series of paragraphs read; it means reflecting on the meaning which the author has conveyed and estimating the relative value of the various thoughts which he has presented; it means planning to put these facts to use in solving some of the learner's own personal problems.

3. This brings us logically to the third and last stage of the process of learning to read, namely, *making use of the facts that we have obtained.* No one has really learned to read aright who does not apply to his own problems and work the thoughts which he has acquired from his reading. For example, if the reader of these lines is actually reading them, he is: (1) taking accurate note of the thoughts which the writer is presenting and trying to understand exactly what is being said; (2)

he is considering the significance of what the author is saying, trying to interpret it in the light of his own experience, thinking of examples of his own, and trying to see how the ideas here presented are related to what he already knows about the problem discussed; and (3) he is taking steps to utilize these ideas in the solution of some of his own problems, one of which should be, in the present case, how the facts here presented may be of service to him in learning to read more effectively.

The end to be achieved by learners of this subject is, therefore, threefold: (1) to acquire the ability to perceive accurately and readily the true meaning of any words that are arranged in proper language form; (2) acquiring the ability to comprehend and interpret the thoughts so obtained in the light of his own knowledge and experience; and, (3) acquiring this information in such a way that it may be recalled and used in the solution of his own personal problems whenever the information acquired is applicable and needed.

The purpose of this paper is to indicate exactly what all learners of this subject must do to attain this goal as they learn to read.

WHAT A PUPIL MUST DO IN ORDER TO LEARN TO READ

The above statement of the ends to be attained in the mastery of this subject has indicated broadly what all learners of this subject must do to attain this goal. A more definite statement, however, of what must be done by those who seek to master this art should be given: (1) in order that teachers and investigators may be able to determine more systematically how each of these necessary things can best be done; (2) in order that they may deal more successfully with the many difficulties which the performance of *these major tasks* presents; (3) in order that they may measure in a concrete and objective way the progress which their learners are making in doing each one of these necessary things; and, (4) in order that they may better test the value of the methods of instruction that are now being used to direct learners of this school subject by noting the kind and amount of help which each method gives to the learner in solving the particular problems which he encounters.

While learning this instrumental school subject, each pupil must do the following things:

I. Master the standard language symbols or words. This presents the following problems:
   1. Assuming and maintaining the right attitude towards this task so that the learner may react and apply himself fully and continuously to his work.

2. Learning to recognize the printed word, phrase, and sentence symbols accurately, and always more easily and quickly.
3. Linking the proper meaning to the printed and written words as soon as they are sensed or seen.
4. Practicing this type of perception until the symbols for the various language units will cause the meaning of these words, phrases, and sentences to arise in the reader's mind without his becoming aware of these language symbols as such.
5. Practicing this type of perception in a way that will enable the learner to acquire greater facility for obtaining the correct meaning from the printed or written words by learning to combine (a) words into phrases, and (b) phrases into sentences.
6. Acquiring the ability to handle the paragraph and any printed selection as a whole, and in a way that will facilitate his understanding of what is written so that he may be able to interpret, evaluate, and use the ideas obtained from the reading.
7. Finally, determining accurately and clearly what the learner's purpose is in the reading and how this purpose may be most effectively executed while he reads.

II. The student must, in the second place, learn to interpret, appreciate, and evaluate the ideas that he obtains from the printed page. This is the key to getting new thoughts from one's reading and to forming right concepts from the experiences one has had and the facts that are being obtained from one's reading of magazines and books.

III. Lastly, the student must learn how to obtain these facts in a way that will enable him to retain, recall, and use them in his thinking and work.

Specific researches and other papers will be needed to show how each of these tasks can best be performed, and to determine what may and should be done by teachers of this subject to motivate this instance of learning, and to give to learners of this subject the specific help that they need to make the learning most economical and effective at every stage of advancement. No learner of this subject can be properly stimulated or most helpfully directed unless his teacher knows first of all just what must be done to attain the goal which he seeks to attain.

This knowledge should help both to find the best ways of doing each one of these necessary things. It should also aid them in eliminating some of the difficulties which this case of learning quite naturally presents. The latter could not be done unless the teacher knew the exact road which his learners must traverse and at what stage of their progress these difficulties in the learning appear.

We may close this brief account of the problems which all learners of this subject must solve by offering a few specific suggestions to those who are trying to help learners in this field to improve their ability to interpret and understand what they read. In helping learners of this subject to solve the various problems which this instance of learning presents, it should be remembered that the ability of a pupil to get the correct meaning from the printed page is dependent upon his previous experience, his mental maturity and strength, and upon his power to think. This makes it imperative that the materials used for the practice in reading be well adapted to the learners' experience, mental capacity, and intellectual needs. If proper attention were given to the matter of selecting suitable reading materials, the problem of improving the pupils' ability to read could be much more easily solved. The following specific suggestions are, therefore, given as a tentative guide for those who are trying to help learners improve their ability to interpret and understand what they read.

1. Select material that can be understood and interpreted by the learners.

2. Arrange matters so that the children will read and work with the *intention* of getting the thought, and understanding what the author has said.

3. By questions or definitely formulated problems given in advance and by other special directions, try to develop in the learners the habit of looking for the essential ideas encountered in their reading. Acquiring skill in this respect will also facilitate the speed of reading because it will show that certain parts of the selection may be read very hurriedly or even omitted.

4. Encourage the learners to stop frequently in order to recall the more important points made by the author. This habit should be developed by means of questions asked by the teacher. If the teacher can give a type of direction that will make the learner occasionally stop and ask himself the questions "what have I really read?" and "what are the essential ideas presented?", he will accomplish two things. First,

he will develop in his learners the ability to get the essential ideas from their reading. Second, he will help them to fix these important ideas more indelibly in their minds.

5. The teacher should also make frequent tests to determine the pupils' reading ability, keeping a record of their score both in speed and accuracy. Such a knowledge of their own success will stimulate the pupils to greater effort, increasing their desire for improved methods of work and will make it possible for them to select things to do that will lead to still greater success. It will also give them practice in the two specific things (speed of recognition and accuracy of comprehension) which must be practiced to improve their ability to read.

This necessary step in learning to read is being emphasized to-day by the best reading texts for the different grades. All teachers of this subject should give special attention to this point because the learner's progress will be greatly increased if he is urged and helped to check up on the actual progress which he is making. This tends to make him notice and select for repetition and emphasis the things that make for progress and success and to eliminate all the responses that are wrong.

It should, however, be remembered that acquiring the ability to interpret and understand what is being read is only one of the major problems which all learners of this subject must solve. In a succeeding paper the writer will explain how language symbols are really mastered or learned, how they come to represent the meanings for which they stand, and the different methods that are used to-day to master new language symbols or words. Other papers will show how the higher orders of reading habits come to be developed and established, and how learners of this subject may be motivated so that their progress in learning will be more rapid and continuous.

THE FUNCTION OF A RESEARCH BUREAU IN A STATE DEPARTMENT OF EDUCATION

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ORGANIZED research in state departments of education is of comparatively recent origin. Previous to 1920 there were only two states which had research bureaus. Previous to 1925 three states had such bureaus. Eleven states have been added within the period from 1925 to 1928. With a movement as new as this one it is of particular importance that an effort be made to define functions. This is necessary for two outstanding reasons. The first reason is that the lack of a clear conception of function is one source of misunderstanding, sometimes leading to difficulties in personal relationships. Chapman [1] included in his questionnaire certain questions in regard to causes of friction. He found that the causes of friction were small in number but well defined. The most important, from the standpoint of frequency, was failure on the part of the research bureau or of its superior officers to define the objectives of the bureau and its functional relationships with other divisions or departments. The second reason for defining the functions of a research bureau may be of greater importance. It is this: If research divisions already organized summarize their experience in regard to functions, considerable assistance will be given to state superintendents who may be contemplating the organization of such divisions in their departments.

The following discussion will attempt to answer certain questions which have been raised by research directors.

Is research a proper function for a state department to assume? Whether or not research has a place in a state department of education will depend largely upon our concept of the functions of a state department of education. Cubberley summarizes these functions very clearly in the following: "The conception of the state as an active, energetic agent, working consistently and intelligently for the moral, intellectual, social improvement and advancement of the people and the betterment of educational conditions throughout the state, instead of acting as a

[1] Chapman, H. B. *Organized Research in Education.* (Columbus, Ohio: Ohio State University Press, 1927), p. 163.

passive statistical agent and tax collector and distributor on the one hand or an arbitrary and technical legal enforcing authority on the other, is one which until very recently has been presented in but few of our American states."[2]

In another place he states, "The careful formulation of . . . minimum requirements, the raising of such requirements from time to time as finances in education permit, the meaning of the reciprocal obligations on the part of the state, involve a clearly conceived and more or less clearly defined constructive state educational policy which looks to a series of progressive changes and the securing of results over a period of years."[3]

I do not think that any one will doubt that research can contribute materially toward the achievement of these goals which Dr. Cubberley has set up. On the other hand, if a state department of education is merely an organization to gather statistics, collect taxes, or enforce laws, there is no specific place for research, because a constructive, forward-looking program is not demanded.

Should research in a state department be differentiated from research in other organizations? The problems facing a state department and, therefore, a research bureau in a state department are in some respects similar and in other respects different from those facing a city school system. Probably the best available data to point out differences is that presented in *Organized Research in Education*.[4] In one table Chapman presents the functions reported by city bureaus of educational research and in another table, the functions reported by state research bureaus. The following functions were carried on by fifty percent or more of both city bureaus and state bureaus:

Achievement testing
Mental testing
Surveys
Test construction
Special investigations other than surveys.

The following functions were performed by fifty percent or more of state bureaus, but by less than fifty percent of city bureaus:

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[2] Cubberley, E. P. *State Educational Organization.* (Boston: Houghton Mifflin Co.), p. 300.

[3] *Op. cit.*, p. 299.

[4] Chapman, *op. cit.*, pp. 173-176.

Guiding research studies of students

Educational information service and preparation of bibliographies.

The following functions were found in fifty percent or more of city bureaus, but in less than fifty percent of state bureaus:

Devising record and report forms

Experimental study of curricular and instructional programs

Training teachers for special testing.

It is obvious that the two kinds of bureaus have many functions in common, the most important of which is testing. While five functions are common, it is probable that they receive different emphasis in the two bureaus. Testing probably occupies a larger portion of the city bureau's time than that of a state bureau.

Chapman's data tend to corroborate our own and others' judgments in regard to the differentiating functions. The state bureau directs research and is a general center of educational information, which functions are not characteristic of the city bureau. On the other hand, the city bureau studies educational efficiency, at least to the extent of preparing report blanks. The fact that one of its functions is to train teachers for testing tends to corroborate the above statement that the city bureau puts more emphasis on testing than does the state bureau. The city bureau also studies curricular and instructional programs. May we infer that the state bureau does less of this type of work but more of research which is fundamental to the formulation of policies and administrative programs? The following quotations tend to warrant this inference: "studies based largely upon comparative statistics should . . . be left largely to state or national bureaus."[5] "Inasmuch as local situations are constantly changing, the state departments of education need to be so equipped that they can study their own problems continuously and thus give more effective and intelligent direction to school work and school expenditures."[6]

Chapman also finds that the state bureau is much more like research bureaus in teachers colleges and universities than it is like city bureaus. Unless there is a difference, however, in function between research in a state department and research in a college or university, how can it justify its existence? The present similarity may be and probably is due to the

[5] Theisen, W. W. "The Function and Value of a Public School Research Bureau." Official Report of the Department of Superintendence, 1929, p. 97.

[6] *Annual Report*, General Education Board, 1926-27, p. 21.

fact that research in both instances has not found its ultimate place. If we consider only those research activities in universities which have a separate organization, such as the Bureau of Educational Research at Ohio State University, then there have been few occasions on which the need for differentiating has been apparent. The need arises only when there are more such bureaus or when a state has research organizations both in its university and state department. Any attempts at differentiating are, therefore, somewhat in the nature of speculation.

We believe that the points of view of university research and state department research are inevitably different. The university must consider the training of its students, the technic, and scholarship, while the practical application is relegated to a place of secondary importance. The state department places most value on that research which aids in developing policies. The training of individuals is of secondary importance. These differences influence the choice of problems undertaken, the procedures adopted, and the methods of presentation. In actual practice, the distinctions are not so clear-cut as this. Much, and even an increasing amount, of university research is functioning in modifying policies and practice.

What is the nature of research problems in a state department and how do these problems arise? Any adequate discussion of the problems appropriate to a research organization in the state department and of the methods for discovering these problems is impossible in an article of this kind. About all that can be done is to indicate the sources from which these problems may arise.

One of these sources is the statistics periodically gathered by the department. They may include data concerning finance, enrollment, attendance, salaries, etc. These are of tremendous value in showing trends and thus indicate needed policies. Because of the research value of such statistics, the research bureau has a vital interest in the forms which are used for collecting these data and quite legitimately should assume, from time to time, the responsibility for revising these forms.

Other problems may come from members of the state department whose responsibility is largely administrative in character. These problems are justifiably referred to a research division for solution. As a matter of fact, the prosecution of such studies can very easily become the major work of the research organization.

It is probable that this research organization should not depend wholly upon problems referred to it by other bureaus of the department, but

should keep in close enough touch with the field in order to sense the problems which are causing most difficulty. This becomes another source of problems. In choosing the problems, the bureau will have in mind those which are found in a fair percentage of the schools. The problems which are local in nature can frequently be studied by local personnel through the assistance and advice of the state director of research. Some of these, however, require more expert assistance than is available locally for their adequate solution and in this case the research bureau must do the work. Another source of problems is found in studies already completed or under way. It is often found by research workers that the study of one problem opens up several others, some of which are as important as the first. Also, one often discovers that the original data throw light on more than one problem. It is always good policy to make the fullest possible use of one's data.

Inasmuch as standards of instruction are one of the responsibilities of the state department, it may sometimes devolve upon the research organization to construct such tests as may be necessary to aid in proper supervision, and to use these and other tests in state-wide surveys. This is an important source of problems to the extent the department assumes supervisory responsibilities.

Probably the most important research problem for the division to undertake, in the mind of the author, is that of analyzing the problems which the state has to face. Such an analysis should be for two purposes. In the first place, it should point out the nature of the problem, and its relationship to other problems and to current practice. In the second place, it should give an appraisal of the relative importance of problems. Time spent upon this activity will result in much saving of effort and in the production of studies of more vital importance to the welfare of the schools of the state. It has the further advantage of furnishing splendid material for use by research students in colleges and universities of the state.

There are two distinctly different policies which might be followed in selecting research problems. Under one policy, the research director would be given his problems by his chief; under the other, he would be given liberty to work on whatever appeals to him as important. In industrial research we can find examples of both policies, but the former is much more frequent. It is not as possible to follow the first policy in education as in industry because the formulation of the problem itself often requires a knowledge of research. The second policy presupposes a

better trained and a more experienced director. It is doubtful if either policy is better; the best, for the present at least, is probably a combination of the two. The preceding sources of problems assumes this combination.

Should all research in the state department be done by the research bureau? If not, how shall we differentiate the research carried on by such a bureau and that carried on by other bureaus or divisions and other individuals within the department? Certain interpretations of statistical data gathered by the state, such as that of determining appropriations, might be carried on better by some other division than that of research. In other words, certain activities which might be interpreted as research, but which tend to be recurring, need not be and probably should not be done by the research organization.

Another possible way of differentiating the activities or the problems to be studied by a research division is to consider them from the standpoint of size. Those problems which are both extensive and complicated cannot usually be handled adequately by men, however well they may be trained, whose major responsibility is that of administration. A piece of research which is extensive or involved must be worked upon intensively and deliberately over a considerable period of time. Such problems can be satisfactorily studied only when all steps, including the original planning, the gathering of data, the tabulation, the statistical treatment, the interpretation, and the final conclusions, are directed by a person thoroughly acquainted with research technic and who can give his major attention to the problem.

It is not desirable, however, that all research activities of the state department be assigned to the research bureau and reported through it. The scientific study of problems should be appreciated by every member of the state department and the research bureau should have a very important function in encouraging this attitude.

What should be the basis of coöperation between the research bureau and other bureaus? In the prosecution of any problem there must be coöperation with all interested agencies. Usually, if not always, this is best cared for through the leadership of the research director. The gathering of data to be used in the study of a problem, while it should be supervised by the research director or his assistants, may be assembled by the official who is in the best position to obtain the desired data most completely. The clerical work may be done in the office of the research

organization or in other offices, but it should be done in accordance with plans worked out with the research director.

In interpreting the data the major responsibility rests upon the research director. He, supposedly, is in a position, more than any other person, to make interpretations unbiased by any administrative consideration. Sometimes, however, interpretations will depend upon a general knowledge of the schools of the state or upon a special knowledge within a limited field which the research worker does not have. In this case assistance must be sought from others. What this interpretation may mean in terms of changed practice and what policies are affected thereby become questions requiring the participation of other officials. In no case should the research director formulate policies, although he may and probably should recommend them. In no case should it be required that he carry out his findings. In both formulation of policies and administration of these policies, he may well act in the capacity of an adviser, contributing his more intimate knowledge of the data upon which policies are to be based.

What functions, if any, should the research bureau perform in the field? The above discussion has been almost entirely about the relationship of the research bureau to members of the department staff. There is another set of relationships of very great importance. These are the relationships with people in the field. Surveys, already mentioned, furnish one kind of contact. These are of most service when they follow as careful a scientific procedure as possible. A survey may be interpreted as an attempt to discover or to solve certain local problems. Other local questions may be met locally through advice and direction of the state director. As an example of such problems we might mention, curriculum construction, classification of pupils, class size, and special difficulties such as, undue percentage of failure, disciplinary questions, costs, etc.

A number of superintendents have found that one of the best means of professional growth of their teachers is their participation in research studies. It is, therefore, of considerable help if the director of research can formulate problems which will involve a simple technic that teachers can handle adequately.

Summary. A research bureau has a vital function to perform in a state department engaged in the formulation of constructive, progressive, educational policies. Such a bureau will stress administrative research, both engaging in such studies and directing others. Secondarily, it will

engage in supervisory and instructional research, and act as a clearing house and reference center. A bureau of this nature should encourage a more scientific study of educational problems not only in the state departments but throughout all the schools of the state. Its problems are generally the more extensive and complicated ones requiring extended study and the direction of a technically trained personnel. Also the problems must be of vital importance to educational practice. The final summaries and interpretations must be simple and practical, resulting in policies which bring about desired changes.

COLLEGE FRESHMEN AND PROBLEM SOLVING IN ARITHMETIC

H. C. CHRISTOFFERSON
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IN the face of dire lamentations on the poor preparation of college freshmen a note of optimism should be eagerly accepted. The following data came from the results of giving the Buckingham Scale for Problems in Arithmetic to 99 college freshmen. A glance at Table I will show that the median for the group was considerably above the eighth-grade standard at the beginning of the year, 58 percent of the college freshmen were above that standard. When one considers that this test was given to a group of freshmen without notice during the first month of school when sorority and fraternity rushing was at its height and these young people were making all sorts of new adjustments the wonder is not that they did so poorly but that they did so well. Add to this the fact that most of these students had had no arithmetic for at least four years, that many of them had had neither algebra nor geometry in high school at all, and also add the fact that the Buckingham test contains some very unreal material, and you will not criticise severely but take pride in their achievement.

Table II gives some still more illuminating data. It shows that in many problems some slight mechanical error was made in computation. Table II is read as follows: Problem 13 was missed by 69 percent of those taking the test. Sixty-seven percent of these made errors in computation; none made errors in method, and 33 percent either did not get as far as problem 13 or omitted it and worked on. In the total, 30 percent of the

TABLE I

SUMMARY OF RESULTS OF GIVING BUCKINGHAM SCALE FOR PROBLEMS IN ARITHMETIC TO 99 COLLEGE FRESHMEN, OCT. 1, 1928

Score	Frequency	Eighth-Grade Norms
94–97.9	6	
90–93.9	21	
86–89.9	24	
82–85.9	12	
78–81.9	15	
74–77.9	16	
70–73.9	3	
60–69.9	2	
Total	99	
Median	86.25	84.
75 percentile	90.52	86.
25 percentile	80.14	79.
Percent above eighth-grade median 58		

TABLE II

SUMMARY OF ERRORS MADE ON THE BUCKINGHAM SCALE FOR PROBLEMS IN ARITHMETIC GIVEN TO 99 COLLEGE FRESHMEN, OCTOBER 1, 1928

Problem Number	Percent Missing	Percent of errors due to		
		Computation	Method	Omission
1	17	76	24	0
2	2	100	0	0
3	13	54	38	8
4	11	36	64	0
5	14	0	100	0
6	22	100	0	0
7	24	43	7	50
8	13	0	85	15
9	33	33	45	22
10	46	2	76	22
11	39	33	38	29
12	50	48	30	22
13	69	67	0	33
14	33	40	15	45
15	56	18	62	20
Total	30*	41	36	23

* Twelve percent missed due to computational errors, 11 percent due to faulty methods and 7 percent omitted or unfinished.

problems were not worked correctly. Forty-one percent of this 30 percent were missed because of errors in computation; 36 percent were missed due to faulty methods, and 23 percent were omissions. Considerably more than half of the errors, not counting omissions, were errors in computation, most of which were seemingly due to haste and general excitement. If the standards on the Buckingham scale are at all reliable it is no discredit to these people that after four years of practical non-participation in arithmetic activities, they, as a group, retained eighth-grade ability in problem solving. This result is the more significant in the light of other studies which show a marked dropping off in rate and accuracy of computation. In other words, during their high-school work they seemingly gained more than enough in maturity of judgment and analytical ability to off-set any loss in computational accuracy due to non-practice.

This generalization can be safely made from the results of Table II, but should also be defended by more specific data. The errors made by all the students in all problems have been carefully diagnosed and the results of this diagnosis are given in detail below for a sampling of the problems.

To avoid any possible misinterpretation of this defense of freshmen, let it be understood that the errors made are not condoned with any idea

of suggesting that the abilities of freshmen in problem solving are adequate for a prospective teacher. No such statement has been made, insinuated nor contemplated. It is suggested, however, that freshmen go to college with a considerable amount of ability in solving arithmetic problems—in fact, with more ability than is often conceded to them. It is further suggested that with the proper stimulation, practice material and methods of attack in connection with their methods courses, freshmen may become sufficiently proficient to enter the teaching field without any separate college course in arithmetic.

The first problem which was missed by 17 freshmen was: "A man bought a house for $7250. After spending $321.50 for repairs he sold it for $9125. How much did he gain?"

Solution:

$7250	$9125	— Selling price
321.50	7571.50	— Total cost
$7571.50	$1553.50	— Profit

The errors due to computation are evident from the following answers; the numbers in parentheses indicate the number making each error: (5) $1554.50; (2) $1543.50; (1 each) $1653.50; $453.50; $1544.50; $1573.50; $1547.50; 1553.49. It is quite evident that these are careless errors. What does an error of one amount to with a freshman during his first month of school even if it is one thousand dollars? Four people made errors in method. They subtracted $321.50 from $7250 getting $6929.50 for net cost which they then subtracted from $9125 for the profit. Such an error can be explained, if not excused, when you realize that these students just had more or less painful experience in subtracting money for expenses.

Problem 2: "How many weeks will it take Joseph to save 21 dollars if he saves 1½ dollars a week?" Answer 14 weeks. Only two missed this and they interpreted his savings at 1½ dollars a day instead of 1½ dollars a week, thereby getting 14 days or 2 weeks.

Problem 3: "George walks at the rate of 2⅓ miles per hour. Henry starts with him and walks in the same direction at the rate of 3 miles per hour. How many miles apart will they be in 3 hours?" Answer 2 miles. Thirteen freshmen missed this problem, which would be a bit difficult to defend as real. One answer was that the boys would be together. This is probably true. Four interpreted it as though the boys were walking in opposite directions. This would make it a better prob-

lem, at least. The other mistakes were computational as follows: Three miscopied, $2\frac{1}{3}$ as $2\frac{1}{8}$ and $2\frac{1}{2}$ and $3\frac{1}{3}$ times 2 instead of $2\frac{1}{3}$ times 3; the other mistakes were 2 times $3 = 5$; 3 times $2\frac{1}{3} = 6\frac{1}{9}$; $2\frac{1}{3}$ used as 2.75; 3 times $3 = 6$; 1 blank. As the total errors for 99 freshmen on this problem on October 1, this does not seem tremendously serious.

Problem 4: "If 0.78 of the weight of potatoes is water how much water in a bushel or 60 pounds of potatoes." Answer 46.8 pounds.

Of eleven students missing this problem, seven divided instead of multiplying and the other four gave such answers as: 44.8, 45.8, 46.86, and 48.8. The last answer was miscopied from the margin where he had 46.8.

Problem 5: "Two boys agree to mow a lawn for 90 cents. If one works one hour and the other four hours how much should each one get?" This problem was missed by fourteen out of 99 students, and all had the wrong method.

Nine used $\frac{1}{4}$ and $\frac{3}{4}$ of 90 cents, while the others guessed or estimated.

Problem 6: "Find the cost of $8\frac{1}{2}$ yards of flannel at 96 cents, $4\frac{3}{4}$ yards braid at 16 cents, 12 yards embroidery at $22\frac{1}{2}$ cents, 10 yards lace at $27\frac{1}{2}$ cents. Answer \$14.37. Twenty-two freshmen missed this problem.

Thus far, a careful analysis of errors has displayed no great alarming lack of judgment in problem solving on the part of these freshmen. A presentation of all the errors would merely repeat the types of errors in these simpler problems. Therefore, a sampling of the remainder should suffice. It will be significant to pick out two or three of the most frequently missed problems and show wherein mistakes were made.

Problem 9 involves percentage: "A real estate dealer made a profit of \$5000 on a plot of ground. The rate of profit was 20 percent. Find the cost of the plot." Answer \$25,000. This was missed by 33 freshmen.

The results on this problem are probably the most serious of all. They indicate a lack of mastery of "Case III" in percentage. Several multiplied:

(5) 20% of \$5000 = \$1000 cost.
80% of \$5000 = \$4000, add \$5000 makes \$9000 cost.
(2) 20% of \$250,000 = \$5000, therefore \$250,000 = cost.
(2) 20% of \$5000 = \$1000 from \$5000 leaves \$4000 cost.
(2) 20% of \$5000 = \$10,000 cost.
(1) 20% of \$5000 = \$100. from \$5000 leaves \$4900 cost.

Others divided something or other:

(4) 20% = $5000 100% = 25000 Therefore $20,000 cost.
(1) 20% = $5000 1% = 250 80% = $2,000 cost.
(1) 20% = $5000 1% = 2.50 100% = $250 cost.
(1) 20% = $5000 1% = 1000 100% = $100,000 cost.
(1) 20% = $5000 1% = 1000 100% = $10,000 cost.
(1) 20% = $5000 1% = 250 Cost is $700.
(1) $5000 ÷ 20 = $2500. Therefore $2500 is cost.
(1) 1% = 250, 20% = 500, $5000 — 500 = $4500 cost.
(1) $5000 ÷ 120 = $41.66. Therefore cost $4166.
(1) 120 ÷ $5000 = .240. Therefore cost is $240.

There were seven entire omissions of this problem.

The results on this problem seem to be unaccountable, but at least one element in the situation does not appear in these facts. Some had the correct answer $25,000 but seemed to discard it as unreasonable. Notice that of the 26 mistakes, 23 were for answers less than $25,000. Most of our students come from smaller villages and nearby cities where $25,000 would buy a whole farm, and $250 or $2500 is far more reasonable for a little "plot of ground."

Problem 13: "In the manufacturing of jute twine the raw jute costs $8\frac{3}{5}$ cents a pound, the spinning $\frac{7}{8}$ of a cent a pound, finishing $\frac{15}{16}$ of a cent a pound. Find the cost of 1500 pounds of jute twine." Answer 1500 pounds at $10\frac{33}{80}$ or 10.4125 costs $156.19. Sixty-eight students out of 99, or 69 percent of them, failed to get this problem correctly worked. This seems unpardonable. Twenty-two of these 68 either omitted it or did not get to it; 18 made errors in adding fractions. Nearly all of these 18 had 80 as the common denominator but made some error in handling the mixed numbers or reducing. Eleven added the fractions, correctly getting $10\frac{33}{80}$ cents per pound but made errors in multiplying. Six changed to decimals using 10.4 or 10.41 as the cost per pound thus getting an error of from 4 to 19 cents on the total. Eight multiplied each price by 1500 but made errors either in multiplying or adding. Three mistakes could not be analyzed due to erasing or not enough work left for diagnosis.

Consider the unreality of the problem which used large fractions instead of decimals, and also the crowded space for working, then this inferior result seems less serious. To have 46 out of 99 students, who had had no arithmetic practice for four years, miss this problem be-

cause of computational errors such as those indicated, and because the problem itself is a bit unreal, is not so bad as it seems at first thought.

If these students are a typical sampling of college freshmen (and we have no reason to believe otherwise), then the following conclusions seem inescapable:

1. College freshmen upon entrance have about eighth-grade ability in problem solving.

2. Most of the errors in problem solving are computational in nature. Since such errors are apt to increase after a long period of non-practice, the students' net problem solving ability seems to have increased above that of the eighth grade.

3. Some practice and training in problem solving is desirable, but the amount is so slight as to suggest that it be incidental in a methods course rather than the primary objective in a separate college course in arithmetic.

In view of the above facts and the present agitation for change in teachers college curricula, the following suggestion is made. Instead of having a college course in arithmetic covering the same old processes and techniques in the same old way which already have been studied for at least eight years in the lower school, would it not be better to have the student meet these processes and techniques in an entirely new situation? Teachers of arithmetic need to experience something of the power, possibilities, and fascination of the simpler fundamental elements of the advanced mathematics upon which our tremendous advance in science depends. Incidentally, such work, if properly presented, would involve much computational practice with the fundamental operations and also practice in problem solving. Such a course would furnish background material to make the prospective teacher feel the need of arithmetic and consequently serve as powerful motivation for a professional course in the teaching of arithmetic.

THE INCONSTANCY OF THE IQ AS MEASURED BY REPEATED GROUP TESTS

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THE study of the growth of school children which is being conducted at the Psycho-Educational Clinic at Harvard University, under the direction of Professor Walter F. Dearborn, has completed its sixth year. During this time a large number of children have been given two or three intelligence tests each year. The material that has been compiled from the results of these tests gives an excellent opportunity for the study of the constancy, or inconstancy, of the intelligence quotient as measured by the same and different group tests.

The variation of the IQ was discussed in this journal,[1] where it was claimed that inconstancy necessarily resulted from the technique of its calculation whenever the quotient was more than a few points above or below 100, and that this error might be avoided by the use of a scale based on standard deviations. The present paper begins with a study of the gains in IQ at the median and quartile points of groups when the same test is repeated at yearly intervals, and closes with a comparison of the results obtained by the IQ technique and those that would result from the sigma index technique suggested by the above authors.

The subjects were selected from a larger group which included all the children from an average community, a suburb of Boston, who were in the first or second grade in 1922-23. This selection included all the children, of North European descent, for whom a record of an Otis test was available for four successive years, a Dearborn test for five or six years, and who were either six or seven years of age when they took the first test.[2]

[1] Dearborn, Walter F., and Long, Howard H. "On Comparing IQ's at Different Age Levels on the Same Scale." *Journal of Educational Research*, XVIII, (November, 1928), pp. 265-274.

[2] The tests were given in the late fall of each year by advanced graduate students who were majoring in the field of educational psychology or educational measurement. The Dearborn General Examination A was given during the first three years, and General Examination C the following three years. In the third and fourth years the Otis Primary Intelligence Test, Form A, was given, the fifth year Form A of the Otis Self-Administering Test, and the sixth year Form B of the latter.

The largest group consisted of 224 children, who were six years old when first tested and who took the Dearborn tests for five successive years. The variations from year to year are large. The medians for the three years in which Dearborn A was given were 103.5, 108.3 and

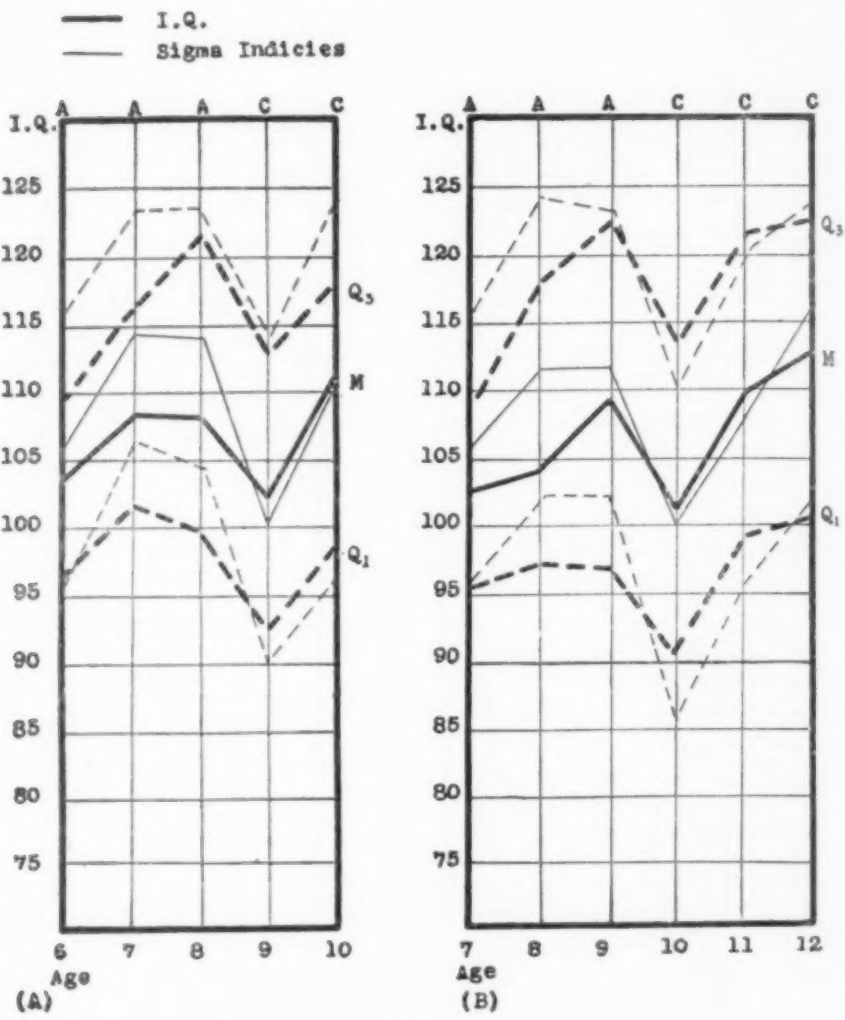

FIGURE I
MEDIAN AND QUARTILE DEARBORN IQ'S AT ONE YEAR INTERVALS

108.0. The lower quartile IQ dropped two points with the second repetition while the upper rose over five points. The tendency for the upper quartile point to rise and the lower one to fall, on the second repetition of the test, was found in several other groups not reported here. When the Dearborn C was introduced in the fourth year, all the quartile points dropped back close to their original positions, but when this test was repeated the following year there was again a marked rise in the median, the gain being nine and one-half points. See Figure I, a.

Another group of 101 subjects who were given the Dearborn tests for six successive years beginning at the age of seven, gave similar results. At ages seven, eight, and nine Dearborn A was given, and at ten, eleven, and twelve Dearborn C. The medians run 102.5, 104.2, 108.9, 102.0, 109.8 and 112.7; the upper quartile points 108.7, 117.9, 122.3, 113.2, 121.2 and 124.4, and the lower quartile points 95.4, 97.1, 96.6, 90.2, 98.8 and 100.2. These figures are shown graphically in heavy lines in (B) Figure I. The similarity of the two groups of curves is striking. Where one differs from the other on the first repetition of the test, it is counterbalanced by a difference in the opposite direction on the second repetition. In both tests the gains between the first and second application is greater than between the second and third, and the gain between the first and second Dearborn C is greater than the corresponding gain in A.

Either poorly adjusted standards or practice effect might cause variation such as are shown in Figure I. The possibility of the standards being the cause is eliminated by a comparison of (A) and (B) Figure I. The curves starting at age six rise and fall in unison with those starting at age seven. They do not, however, rise and fall at the same age, but in accordance to the number of times the test had been previously taken. Thus the six-year-old group rises between six and seven, but when the second group, at seven, took the test for the first time, the IQ's corresponded more nearly to those of children at the age of six than at the age of seven. The same is true at the other points. The standards were further tested by comparing the Stanford-Binet IQ of 146 pupils with the IQ's obtained from the first application of the Dearborn A; the median IQ's were 101 and 102, respectively.

The authors believe that the factor of practice is important, perhaps the main cause of the excess of gains over losses, but are aware that other factors are at work. There are many individuals who show losses instead of gains, and, it will be noted, the lower quartile point of both

groups and the median of one are slightly lower on the second than on the first repetition of Dearborn A.

If the effect of practice is carried over a year, it would be interesting to know how much longer it is carried. Sixty cases were available of those who had been given Dearborn A the first and third years, but who were absent the second. The median IQ's were 100.4 and 96.5 respectively. No conclusions can be based on such meager evidence, but insofar as it goes, no indication of practice effect being carried over two years is shown.

A similar study of the Otis test proved to complicate rather than clarify the results. An Otis test was introduced in the third year of the investigation and one or another was given for the three following years. The median, the upper and lower quartile IQ for each of 148 pupils who took the Otis test for the first time at the age of eight years, are plotted in (A) Figure II and a group of 157 subjects who took it for the first time at age 9 in (B) Figure II. Except for the fact that the second group is uniformly about 5 points below the first group, the similarity of the two groups of curves is again striking. In the younger group the median IQ was 111 the first time the primary test was given. When it was repeated, instead of a gain as was expected after a study of the Dearborn tests, there was a drop of three points, and the following year at the age of ten when the Self-Administering Test, Form A, was introduced, it dropped down to 99, 13 points lower than it had been two years previous. But the next year when a different form of the same test was given it rose to 107. These variations are large—larger than were found in the Dearborn tests—but they cannot be so readily attributed to practice. No evidence of having profited from previous exposure is seen in the Primary Test, the only one given twice. Instead, as already stated, a slight decrease occurred in both groups. If any practice effect is present it is hidden by factors causing variation in the opposite direction. Inconsistencies in the standards appear to be a complicating factor in this instance, and, it may be, that they are of such a nature as to counterbalance gains due to practice. The indications are that the standards for the Primary Test, Form A, are too low. One hundred-eleven is certainly high for the median IQ of a group of unselected children, and as further evidence, it may be pointed out that the group of 146 cases mentioned above, who obtained a median IQ of 102 on the Dearborn test and 101 on the Stanford-Binet Test made 112 on the Otis the first time it was given. If it should be that the pub-

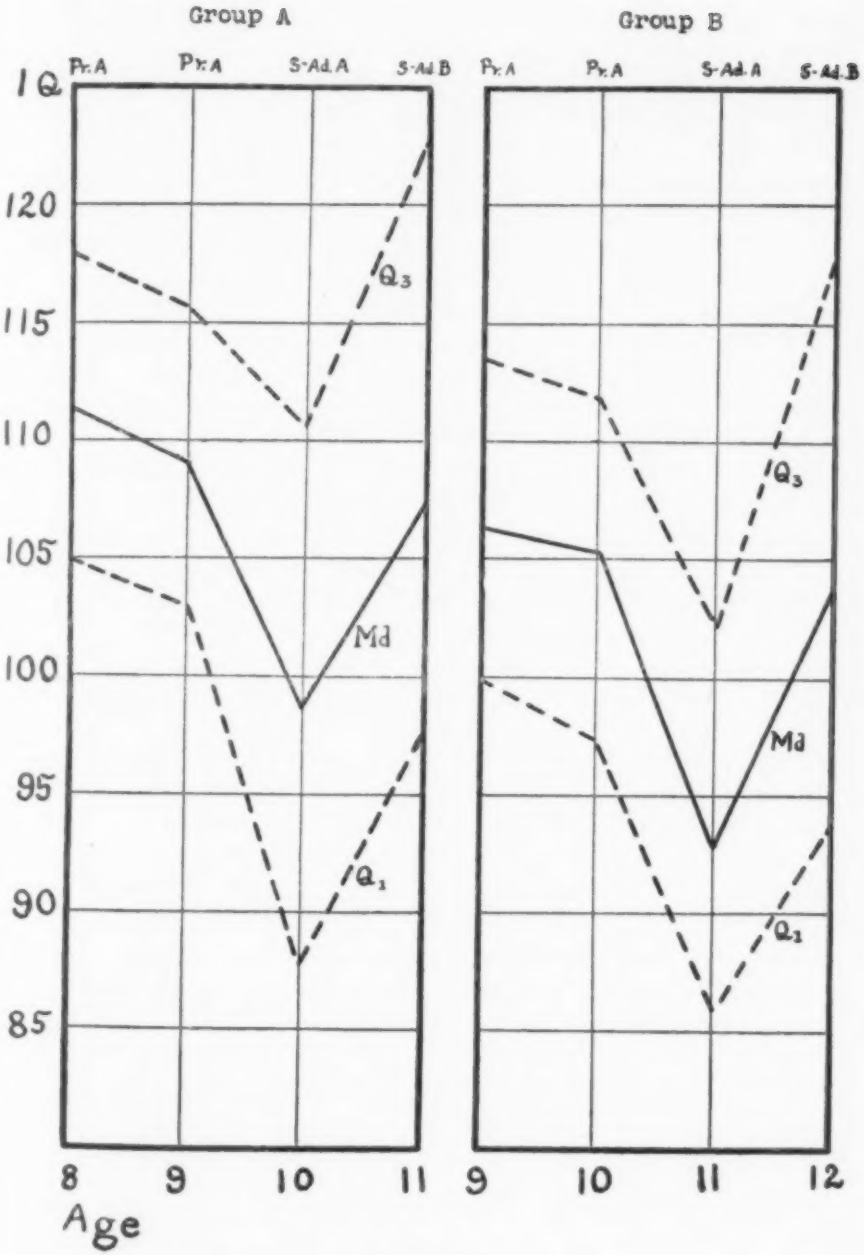

FIGURE II
MEDIAN AND QUARTILE OTIS IQ'S AT ONE YEAR INTERVALS

lished norms for the Otis Primary Test are 10 or 12 points low at age eight, and gradually increase as they ascend the age scale, it would explain the form of the curves and account for no practice effect being evident, but the data at hand are not sufficient to settle the point.

When the Self-Administering Test, Form A, was given, at the age of 10 in one group and 11 in the other, the IQ's dropped back to normal, but when Form B was given the following year, there was a gain of 9 points at the median of one group and 11 at the other. Whether this rise was due to the practice effect of having taken Form A the previous year, to difference in standards, or to some other unknown cause, is not clear.

For a study of the IQ increments in groups of different intelligence levels, a group of 147 subjects were divided into three sections of 49 each in accordance with their rank on the first application of the Dearborn A and C. The median increments of the upper, middle, and lower sections, for the five years together with the median IQ of the first, are given in Table I.

The size of the increments do not vary consistently with the intelligence level of the group, though the gain is frequently greater in

TABLE I

THE MEDIAN GAIN OR LOSS IN IQ BETWEEN ONE YEAR AND THE NEXT IN GROUPS OF DIFFERENT IQ LEVELS

	Median IQ	1st Inc.	2nd Inc.	3rd Inc.	4th Inc.	5th Inc.
			Dearborn Increments			
Upper	110	+7.1	+7.5	—6.6	+8.2	+2.7
Middle	101	+6.0	+4.6	—8.2	+9.2	—0.2
Lower	93	+7.2	+0.8	—11.7	+6.6	+2.9
			Otis Increments			
Upper	118	+0.2	—8.4	+14.8	—	—
Middle	112	—1.4	—13.5	+12.5	—	—
Lower	104	—0.4	—9.8	+9.0	—	—

the upper, and less in the lower group. The greatest gain is found in the upper section and the smallest gain in the lower in the second year of the Dearborn test, in the third year of the Otis, and in the total gain of the two years of Dearborn A, also the loss is greatest in the lower group and least in the upper in the fourth year of the Dearborn. In the other years no uniform tendency is seen. It is interesting to note, that while the total gains over a period of three years with the Dearborn A were 14.6, 10.6 and 8.0 for the upper, middle, and lower groups, respectively, the losses which took place when Dearborn C was introduced were 6.6, 8.2 and 11.7 for the three groups in the above order.

Yet in the main experimental groups the median IQ of Dearborn A and C were nearly equal.

As additional evidence pointing toward learning as a cause of the variation in IQ when a test is repeated year after year, it may be pointed out that the Second Annual Report of the Commission on Scholastic Aptitude Tests reports a gain of 40 points or .4 sigma in the Scholastic Aptitude Test when it was taken a second time after a lapse of 9 to 12 months, even though a different form was used. This result is based on about 400 cases. All were high-school graduates, hence they had passed the age when it is ordinarily believed that full mental growth has been attained. This test is modeled after the usual type of group intelligence tests and is such that additional courses in school subjects would have no direct bearing on the test scores. The test is re-standardized each year on over 7,000 cases and the gains reported are not absolute, but relative to the total groups, hence the gain cannot be attributed to variations in standards. A small group of 47 subjects repeated the same form of the test after an interval of three or four months, here the gain was .54 sigma.

In terms of sigma the gains herein reported for the Dearborn IQ are nearly identical to those found for the Scholastic Aptitude test. The increase in Dearborn A between the ages of six and seven was .4 sigma, between seven and eight .3 sigma; and for Dearborn C between nine and ten .4 sigma and between ten and eleven .5 sigma.

Professor Walter F. Dearborn and Mr. Howard H. Long in an article in the November, 1928, issue of this journal "raise the question whether or not on a given scale a child who maintains a constant position with reference to the average of his group will nevertheless secure different IQ's because the scale means different things at different levels" and whether or not sigma indices as proposed by Franzen would give a truer measure of the child's mental development. They described the method as follows:

"Franzen resorted to the device of assigning arbitrarily one hundred as the average score for each age level and twenty points to each sigma. In this way the sign of the sigmas is ignored. An individual who is one sigma above the means of his age group has a sigma index of 120. If he is one sigma below the average of his group he has a sigma of 80. If he is four sigma below, he has a sigma index of 20 and if four sigmas above, 180. The sigma indices have the advantage of being very much like the IQ's on the Binet scale in size and, not differing from them widely in meaning."

One of the above authors suggested the possibility that discrepancies in IQ reported above might be due to weaknesses in the IQ technique rather than to relative increase in the test scores. This was put to a test by selecting a hypothetical case such that its CA was the mid-point of the age group of our 224 cases (tested first at the age of six) and whose IQ, year for year, was the median of this group. From the given CA's and IQ's the mental ages were calculated. Then referring to the table of norms in the manual, the score corresponding to each MA was determined, and finally each sigma index was obtained by referring the score to a sigma scale constructed from the the data on which the Dearborn tests were originally standardized. In the same way the sigma indices were found for five other hypothetical cases, one for each quartile point of the two groups. The sigma indices are plotted in light lines in Figure I. If, as stated, the sigma indices are "very much like the IQ's on the Binet scale in size," a glance at the curves shows that the variations, whatever may be their cause, are about equally great whether expressed in terms of sigma indices or IQ's. The greatest gain in IQ over two years in the Dearborn test, when expressed in terms of standard deviations, and the greatest gain in the sigma index are both .8 sigma.

Mr. Long's prediction that high IQ's would increase and the low IQ's decrease with age is not born out insofar as repeated tests are concerned, both the low and the high groups gaining. It is true, that if we compare the first Dearborn A with the first Dearborn C, taken two years later, it will be seen that the IQ at the upper quartile point rose 3 or 4 points while the lower dropped 4 or 5, but the variations in terms of sigma indices are in the same direction and, if anything, a little larger.

The above study appears to justify the following conclusions:

1. There is on the average, a distinct gain in IQ when the Dearborn Intelligence Test, General Examination A or C is taken for a second time after the lapse of one year, and a lesser gain when it is taken again at the end of the second year.

2. The gains are probably due to practice, but not merely to familiarity with the general test situation, since the IQ's drop back to normal when a new test is introduced.

3. The variations are equally large whether measured in terms of IQ or the sigma indices proposed by Franzen.

4. No gain was found when the Otis Primary Test was repeated after one year, but indications of inconsistencies in the standards made it impossible to determine whether or not a practice effect existed.

A STUDY OF VARIOUS FACTORS WHICH INFLUENCE THE USE OF THE ACCOMPLISHMENT QUOTIENT AS A MEASURE OF TEACHING EFFICIENCY

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THE present article reports changes in Accomplishment Quotient over a one- and two-year period, for pupils of Grades 3A to 6A in the public schools of Shaker Heights, Ohio.[1] The average ability of the children studied is considerably higher than that in the average school system, since the median IQ for the total enrollment of the four elementary schools involved is approximately 114, and less than 25 percent of the pupils have IQ's below 100. The teachers who taught these classes were unusually well trained, and perhaps represented a higher selection among teachers in general than did the children among children in general. The school buildings were modern and well-equipped. Classes were small; the average number of pupils per teacher at the end of the period was 19, and the largest class included in this study numbered only 29. In general, conditions for teaching and learning were unusually good.

The Stanford Achievement Test was administered in May of each year to all pupils in Grades 2A to 6A, inclusive. Form A was used in 1924 and 1926, and Form B in 1925. In 1926 the 3A pupils took the Advanced Form of the test, since experience in the preceding years indicated that the Primary Form was too easy for the 3A pupils.

The mental ages used in computing the AQ were, in general, calculated from IQ's based on group tests. Stanford-Binet IQ's were available for about 15 percent of the pupils, and these were used in preference to the group test IQ's. Most of the latter were obtained from the McCall Multi-mental Scale which was administered during October and November, 1925. In the few cases where the record for that was not available, IQ's were based on the National Intelligence Test A for the older children, and on the Pintner-Cunningham Primary Test for the younger pupils. The two or three mental ages used for each child were based on the same IQ. Thus, in the case of the AQ comparison from May, 1925 to May, 1926, the mental ages were based on a single intelligence test which had been taken half way between the two educa-

[1] B indicates the lower half, A the upper half, of each grade.

tional tests. In the case of the 1924 AQ's the mental age was based on an intelligence test taken one and one-half years *after* the educational test.

The reliability of both the Stanford Achievement Test and the McCall Multi-mental Scale is high. For the former test, the reliability coefficient is .95 in Grades 2 and 3, and .96 in Grades 4 to 9. For the Multi-mental Scale, the correlation of odd and even numbered items is .87. By the Spearman-Brown formula the self-correlation of the whole test becomes .94.[2]

The educational age was based on the Stanford Achievement Test. From these scores and a mental age based, in most cases, on the Multi-mental, two or three AQ's were computed for each pupil. There are 212 children for whom we have AQ's for 1924, 1925 and 1926, and 461 who have AQ's for 1925 and 1926. There were 27 pupils in school in May, 1926, for whom we have only a 1926 AQ and 46 for whom we have no AQ.

ACCOMPLISHMENT QUOTIENT CHANGE OVER A ONE-YEAR PERIOD

The average AQ for each year was computed for each class and for each total grade. The total grade includes the records of all pupils in a given grade from four different buildings. Class is used to indicate children of a given grade who were taught by a single teacher. The pupils in each total grade were drawn from three to seven classes, as is shown in Table X. The average AQ's for total grades for 1925 and 1926, the SD of each distribution, the average 1925-26 AQ difference, the SD of the difference, and the Experimental Coefficient are shown in Table I.

In 1925 only one total grade had an average AQ below 100, namely, the 6A, which had an average AQ of 98.68. In 1926 no grade had an average AQ below 100. Three grades fell between 101.0 and 102.0, two between 102.0 and 103.0, one between 103.0 and 104.0, and one between 104.0 and 105.0. It is thus evident that in May 1926 the AQ standing of the pupils was, on the average, somewhat better in the Shaker Heights system than in the average school systems throughout the United States. The highest average AQ was made by the 75 children of Grade 3A, with a score of 104.11; the lowest, by the 90 pupils of 5A with a score of 101.73, and by the 74 pupils of 6A, with a score of 101.74.

Of more interest than these average AQ's is the change in AQ from

[2] McCall, W. A., and his students. "Construction of the Multi-mental Scale," *Teachers College Record*, XXVII, 409.

1925 to 1926. The largest gain, a gain of 4.06 points, was made by Grade 3A; the next largest, 3.06 points, by 6A. Two grades, 4B and 5B, lost in AQ from 1925 to 1926. When these gains and losses are considered in connection with the reliability of the 1925-26 difference, the gain of the 3A grade is found to be statistically significant, there being only one chance in a thousand that the gain was not real. The experi-

TABLE I

COMPARISON OF 1925 AND 1926 AQ'S FOR TOTAL GRADES

	No. in Grade in 1926	No. in AQ Comparison	1925 AQ's		1926 AQ's		1925-26 Change		
			Average	S.D.	Average	S.D.	Average	S.D. of Diff.	Exp. Coef.
3A	95	75	100.05	7.93	104.11	5.94	4.06	1.14	1.12
4B	48	42	103.52	8.14	103.17	6.29	− .35	1.59	.07
4A	95	81	101.99	6.92	102.95	5.97	.96	1.02	.31
5B	62	58	103.81	8.74	102.12	8.53	−1.69	1.26	.45
5A	101	90	101.27	8.02	101.73	7.62	.46	1.17	.13
6B	47	41	100.12	9.45	101.83	8.70	1.71	2.01	.28
6A	86	74	98.68	9.14	101.74	9.33	3.06	1.52	.67
Total	534	461	101.21	8.47	102.52	7.95	1.31	.54	.81

mental coefficient for 6A indicates a fair reliability for the gain made by this group, there being about one chance in thirty that the gain was not real. In Grades 6B, 5A and 4B the experimental coefficients are so low that we cannot be at all sure that the differences are significant. In the 5B and 4A grades there is some probability that the 5B grade lost and that the 4A grade gained. When we consider the total group of 461 pupils we find that the average AQ for 1925 was 101.21, and that the average AQ for 1926 was 102.52, with a gain of 1.31 points. The reliability of these differences, as shown by an experimental coefficient of .81, is good.

In Table II the detailed frequencies of 1926 AQ's for each grade have been given because of their possible interest as a basis of comparison with AQ's found in other school systems. These distributions and similar ones for 1925 show a slight skewing toward the lower AQ's. The skewness is more marked in the 1925 distributions, and the total variability as shown by the S.D. is slightly higher in 1925. In Table III the complete distributions for 1925-26 AQ change are shown. This distribution is somewhat skewed toward *plus* change; this is due in the main to the large gains in Grade 3A.

The scores for 1925 and 1926 may be compared by computing coefficients of correlation between them. The coefficients found for each

TABLE II

DISTRIBUTION OF 1926 AQ'S BY GRADES

AQ's	3A	4B	4A	5B	5A	6B	6A	Total
126	1							1
124							1	1
122							1	1
120				3			1	4
118	2	1	1		1	1	1	7
116		1	1	1	1	1	1	6
114	1		3	2	3	3		12
112	3	1		2	4	2	5	17
110	7	3	4	2	6	3	4	29
108	3	1	8	3	7		7	29
106	10	6	10	1	6	2	4	39
104	9	9	10	11	9	2	8	58
102	13	7	10	4	11	6	3	54
100	9	5	11	7	9	6	8	55
98	12	1	10	8	9	5	7	52
96	2	1	6	6	4	2	6	27
94	2	1	2	2	4	1	2	14
92		4	3		9	1	4	21
90					2	1	5	8
88			1	2	3	3		9
86		1	1	3	1	1	2	9
84	1						2	3
82							1	1
80						1		1
78				1	1		1	3
No. Cases	75	42	81	58	90	41	74	461
Average	104.1	103.2	103.0	102.1	101.7	101.8	101.7	102.52

TABLE III

DISTRIBUTION OF 1925-26 AQ CHANGES BY GRADES

AQ's	3A	4B	4A	5B	5A	6B	6A	Total
20	1							1
18	1							1
16	2							2
14	3							3
12	4					1	1	6
10	4					1	4	9
8	5	3	4	1	1		4	18
6	12	1	9	3	4	5	16	50
4	11	3	10	4	10	6	9	53
+2	10	10	12	6	21	9	12	80
0	6	5	14	6	19	7	12	69
—1	1	8	15	13	19	5	7	68
3	6	5	13	7	11	3	7	52
5	3	2	1	9	4	3		22
7	2	2	1	7	1	1	1	15
9	3	1	2	2			1	9
11	1	2						3
No. Cases	75	42	81	58	90	41	74	461
Average	4.08	—.38	.94	—1.71	.46	1.71	3.07	1.312

grade and for the total group are shown in Table IV. With the exception of Grade 3A the coefficients are high and statistically significant. At the time this study was planned there was no intention of making use of coefficients of correlation between the AQ series for various years. Chronological ages were not included in the lists of data on which computations reported in this article were based. It is, therefore, impossible

TABLE IV

COEFFICIENTS OF CORRELATION BETWEEN 1925 AND 1926 AQ'S

	No. of Cases	r.	S.D. of r.
3A	75	.577	.077
4B	42	.817	.051
4A	81	.782	.043
5B	58	.856	.035
5A	90	.886	.023
6B	41	.874	.037
6A	74	.870	.028
Total	461	.820	.015

to compute coefficients of correlation between AQ and AQ, with CA held constant. Thus, in the case of the data of Table IV all of the coefficients are probably somewhat too high. The size of the coefficients will also be influenced by the reliability coefficients of the intelligence and achievement tests used, and by the correlation between the two types of tests. Because of the number of factors involved, interpretation of coefficients of correlation between AQ's is a complex problem. In the present instance, since the main argument does not depend on correlations, we shall not attempt to interpret the data of Table IV, but simply present them for the reader's inspection.

ACCOMPLISHMENT QUOTIENT CHANGE OVER A TWO-YEAR PERIOD

Of the 461 children whose records are reported in the preceding section, there were 212 who had been present not only for the Stanford Achievement Tests in 1925 and 1926, but also for Form A of the test in 1924. For these 212 children we may compare AQ averages for 1924, 1925 and 1926. Children who were in 2A in May 1924 were, in general, in 4A in May 1926; there were 46 children in this group. One hundred two pupils who were in Grades 3B and 3A in 1924 were in 5B and 5A in 1926. Sixty-four pupils who were in 4B and 4A in 1924 were in 6B and 6A in 1926. The average AQ's and the average AQ changes for 1924-25, 1925-26 and 1924-26 are shown in Table V.

For the total group of 212, the 1924 average AQ was 99.88, the 1925 average was 102.02, and the 1926 average was 102.3. For this group there was a gain of 2.14 for the 1924-25 interval, and a gain of only .28 for the 1925-26 interval. In the separate groups, the youngest group shows a gain in each successive year. The middle group loses slightly from 1925 to 1926; the oldest group loses from 1924 to 1925, but gains from 1925 to 1926. The reliabilities of these changes may be noted from the experimental coefficients in Table V.

Coefficients of correlation were computed for the 212 pupil group between AQ's of the different years. For the 1924 AQ's correlated with 1925 AQ's, r = .811; 1925 with 1926 AQ's, r = .872; and 1924 with 1926 AQ's, r = .792. The Standard Deviations of these coefficients are, respectively, .024, .016 and .026.

TABLE V

AVERAGE AQ'S AND AQ DIFFERENCES FOR 1924, 1925 AND 1926

		1924 AQ's		1925 AQ's		1926 AQ's	
Grade	No. Cases	Average	S.D.	Average	S.D.	Average	S.D.
4A	46	99.07	9.21	102.94	7.31	103.03	6.34
5B-5A	102	99.76	9.10	102.75	8.65	102.02	8.43
6B-6A	64	100.67	10.45	99.84	9.42	101.08	9.20
Total	212	99.88	9.56	102.02	8.55	102.30	8.04

	1924-25 Change			1925-26 Change			1924-26 Change		
	Average	S.D.	Ex. Coef.	Average	S.D.	Ex. Coef.	Average	S.D.	Ex. Coef.
4A	3.87	1.74	.74	.09	1.44	.02	3.96	1.66	.80
5B-6A	2.99	1.24	.80	−.73	1.20	.20	2.26	1.23	.61
6B-6A	−.83	1.76	.16	1.24	1.65	.25	−.59	1.74	.11
Total	2.14	.88	.81	.28	.81	.11	2.42	.86	.978

RELATION OF INITIAL ACCOMPLISHMENT QUOTIENT TO CHANGE IN ACCOMPLISHMENT QUOTIENT

The question is often properly raised as to whether a teacher who begins the year with a class who has a comparatively high average AQ, —105, for instance,—has as good an opportunity of raising the AQ of the group as a teacher whose class has an AQ of, for instance, ten points lower. In Shaker Heights schools there is a definite tendency for children who begin the year with a high AQ not to gain in AQ during the following year as much as do children whose initial AQ is low. If we consider class averages, the data in Table X show that, of 5 classes of ten or more children that had a 1925 AQ of 103.5 or higher, every class lost in AQ in 1926. In general, the higher the 1925 AQ, the greater the loss. Of the 11 groups that lost in AQ from 1925 to 1926, only three

had 1925 AQ's below 103.5. Of these three, two had losses of only one-tenth of a point.

In addition to the facts shown by class averages, we tabulated the individual AQ changes from 1925 to 1926 according to four initial (1925) groups. These initial AQ groups are: (1) AQ's of 94 and lower; (2) AQ's from 95 to 99, inclusive; (3) AQ's from 100 to 104, inclusive; (4)

TABLE VI

AQ CHANGE FROM 1925 TO 1926, FOR DIFFERENT INITIAL AQ GROUPS

	3A, 4B, 4A				5B—5A			
Initial AQ	No.	Average	S.D.	S.D. of Av.	No.	Average	S.D.	S.D. of Av.
94 & below	34	7.06	4.99	.86	23	1.48	2.26	.47
95-99	37	4.14	3.71	.61	30	.97	3.60	.66
100-104	61	1.39	4.10	.53	30	−.53	3.09	.56
105 & above	66	−1.50	5.68	.70	65	−1.62	4.16	.52

	6B—6A				Total			
	No.	Average	S.D.	S.D. of Av.	No.	Average	S.D.	S.D. of Av.
94 & below	33	4.58	3.58	.65	90	4.72	4.64	.49
95-99	17	2.00	3.45	.84	84	2.57	3.90	.43
100-104	31	1.58	4.58	.81	122	.97	4.10	.37
105 & above	34	2.85	4.49	.77	165	−.89	5.07	.40

TABLE VII

DIFFERENCE IN AVERAGE AQ CHANGE (1925-26) BETWEEN GROUPS WHOSE INITIAL AQ'S ARE AS INDICATED

(The figure in parentheses is the Experimental Coefficient of the Average Difference Shown)

	3A, 4B, 4A (n = 198)	5B-5A (n = 148)	6B-6A (n = 115)	Total (n = 461)
(94–) compared with (105+)	8.60 (2.55)	3.09 (1.47)	1.72 (.57)	5.61 (2.97)
(95–99) compared with (105+)	5.64 (2.02)	2.58 (1.03)	−.85 (.25)	3.46 (1.99)
(100–104) compared with (105+)	2.89 (1.10)	1.08 (.47)	−1.27 (.32)	1.86 (1.14)
(94–) compared with (100–104)	5.67 (1.88)	2.01 (.91)	3.00 (.96)	3.76 (2.04)
(94–) compared with (95–99)	2.92 (.93)	.51 (.21)	2.58 (.81)	2.15 (1.11)
(95–99) compared with (100–104)	2.74 (1.13)	1.50 (.58)	.42 (.12)	1.60 (.95)

AQ's of 105 and higher. The averages for these four groups, both for the total of 461 pupils and for three grade groupings, are shown in Table VI. For the total group, the average AQ change from 1925 to 1926, for pupils whose AQ's were 94 or lower in 1925, was a gain of 4.72 points; for initial AQ's of 95-99, a gain of 2.57 points; for initial AQ's of 100-104, a gain of .97 points; for initial AQ's of 105 or higher, a loss of .89 points. The difference from one AQ group to another, as well as the ex-

perimental coefficients of each difference, is shown for the total group in the last column of Table VII. It will be seen that in every comparison the group with lower initial AQ gained more than that with a higher initial AQ, and in every case the difference has high reliability.

THE ACCOMPLISHMENT QUOTIENTS OF GROUPS WITH DIFFERING IQ'S

The average 1926 AQ's, as well as the average 1925-26 AQ changes, were computed for different IQ groups. The grouping was by ten-point intervals. The results are shown in Table VIII. Fourteen of the total group of 461 pupils were not included in this tabulation; 7 had IQ's below 81, and 7 had IQ's above 150. There were too few cases in these highest and lowest IQ groups to give results of any reliability.

Considering the column of 1926 averages in Table VIII, we find that the higher the IQ group, the lower the AQ. The average 1926 AQ for the 81-90 IQ group is 106.86; that for the 141-150 IQ group is 94.71,—a difference of 12 points. If the IQ's over 130 were accurately determined, it is evident that these children are not living up to their ability

TABLE VIII

1926 AQ'S AND 1925-26 AQ CHANGE FOR IQ GROUPS (3A-6A)

IQ's	No.	1926 AQ's Average	1926 AQ's S.D.	1925-26 AQ Change Average	1925-26 AQ Change S.D.	1925-26 AQ Change S.D. of Average
81-90	28	106.86	5.97	—.89	5.34	1.01
91-100	65	106.31	5.84	1.00	4.66	.57
101-110	101	105.73	6.68	.86	4.80	.47
111-120	108	103.28	6.03	2.00	5.51	.53
121-130	82	99.28	6.44	1.20	4.77	.53
131-140	42	95.74	7.80	1.64	4.73	.73
141-150	21	94.71	6.91	4.29	4.00	.87

Diff. between Av. Change of 81-90 IQ group and 141-150 IQ group = 5.18 Ex. Coef. = 1.20
Diff. between Av. Change of 91-100 IQ group and 141-150 IQ group = 3.29 Ex. Coef. = 1.05
Diff. between Av. Change of 101-100 IQ group and 141-150 IQ group = 3.43 Ex. Coef. = 1.15

Diff. between Av. Change of 111-120 IQ group and 141-150 IQ group = 2.29 Ex. Coef. = .75
Diff. between Av. Change of 131-140 IQ group and 141-150 IQ group = 2.64 Ex. Coef. = .78
Diff. between Av. Change of 81-90 IQ group and 111-120 IQ group = 2.89 Ex. Coef. = .85

Diff. between 1926 Av. of 81-90 IQ group and 141-150 IQ group = 12.15 Ex. Coef. = 2.12
Diff. between 1926 Av. of 81-90 IQ group and 121-130 IQ group = 7.58 Ex. Coef. = 1.89
Diff. between 1926 Av. of 81-90 IQ group and 111-130 IQ group = 3.58 Ex. Coef. = .94
Diff. between 1926 Av. of 111-120 IQ group and 141-150 IQ group = 8.56 Ex. Coef. = 1.73
Diff. between 1926 Av. of 121-130 IQ group and 141-150 IQ group = 4.57 Ex. Coef. = .90

as well as we would like to have them do. Turning now to AQ changes from 1925 to 1926 we find that the greatest improvement is made by pupils with IQ's from 141 to 150. In 1925 these pupils' average AQ was only 90.4 and during the following year it increased 4.29 points. The 131-140 IQ group has improved a little, but not as much as would

seem desirable. The 81-90 IQ group has lost slightly, suggesting that they had been urged to a degree of achievement which they could not maintain.

A few of the differences in 1926 average AQ, and in average 1925-26 change, for different IQ groups, with experimental coefficients, are shown in the lower part of Table VIII. The most striking difference in AQ change between the 81-90 group and the 141-150 group has high reliability.

It seemed worthwhile to consider also the average AQ's for different IQ groups for the cases having three annual AQ's. In Table IX are shown average AQ's for 1924, 1925, and 1926, and 1924-26 AQ changes, for 204 pupils with IQ's ranging from 81 to 150. The data presented in this section indicates that low IQ's tend to have markedly higher AQ's than do high IQ's; that there is a slight tendency for low IQ pupils, with high initial AQ's to *lose* in AQ over one or two year periods, and a rather marked tendency for very high IQ's with low initial AQ's to *gain* in AQ over one- or two-year periods.

TABLE IX

1924, 1925, AND 1926 AQ's FOR IQ GROUPS (4A-6A)

IQ's	No.	1924 AQ's Average	1924 AQ's S.D.	1925 AQ's Average	1925 AQ's S.D.	1926 AQ's Average	1926 AQ's S.D.	1924-26 AQ Change	1924-26 Ex. Coef.
81-90	12	109.8	5.27	110.9	5.39	108.3	6.58	—1.58	.22
91-100	26	106.0	7.57	106.7	6.17	106.8	6.28	.88	.15
101-110	45	104.7	6.71	106.2	6.05	105.8	6.79	1.09	.26
111-120	50	101.1	5.53	102.9	5.77	103.2	5.08	2.10	.66
121-130	29	95.8	8.60	98.8	7.70	98.6	7.06	2.79	.45
131-140	29	91.1	6.81	93.0	7.16	94.4	7.63	3.31	.60
141-150	13	87.0	8.60	91.1	7.70	95.2	7.26	8.15	.87

THE USE OF THE ACCOMPLISHMENT QUOTIENT TO MEASURE THE EFFICIENCY OF INDIVIDUAL TEACHERS

It has often been suggested that the AQ will provide a useful measure of the teaching efficiency of individual teachers. With this in mind we tabulated the AQ changes for the separate classes in the different schools. In Table X, in addition to the 1925 and the 1926 average AQ's and the average AQ change, there are shown the total number of pupils in each class in May, 1926, the number in each class for whom we have both a 1925 and a 1926 AQ, the percentage of the latter group who were "new" in Shaker Heights schools in September, 1925, and the average IQ of the pupils considered in the AQ comparison. There were nine teachers who had a combination grade group, such as a 4B-4A group in the same

TABLE X

COMPARISON OF 1925-26 AQ'S FOR SEPARATE CLASSES

School	Grade	Teacher	No. in Class in 1926	No. in AQ Comparison	% of New Pupils in AQ Comp.	Aver. IQ	1925 AQ's Aver.	1925 AQ's S.D.	1926 AQ's Aver.	1926 AQ's S.D.	1925-26 AQ Diff.	S.D. of Diff.	Exper. Coef.
Blvd.	3A	Po.	19	12	0	117.6	109.31	9.37	104.62	6.62	−4.69	3.31	.47
Blvd	3A	Ph.	6	5	40	110.0	102.80		107.0		4.20		
Blvd.	3A	T	10	9	11	110.9	98.67	3.92	102.89	3.93	4.22	1.85	.76
More.	3A	H	29	23	26	120.3	96.87	7.08	105.09	7.32	8.22	2.14	1.28
Mal.	3A	T	21	18	28	115.6	98.61	5.90	103.50	3.83	4.90	1.66	.985
Sos.	3A	H	10	8	25	112.0	98.25	6.04	101.38	7.62	3.13	3.43	.30
Total	3A		95	75	21	115.8	100.05	7.93	104.11	5.94	4.06	1.14	1.12
Blvd.	4B	M	12	10	0	116.3	110.20	6.91	104.20	6.57	−6.00	3.02	.66
Blvd.	4B	Ph.	13	12	0	121.8	102.17	6.23	103.08	5.36	.92	2.38	.13
More.	4B	B	6	5	0	123.4	101.40		103.00		1.60		
More.	4B	D	7	7	0	97.0	104.60		104.00		−.60		
Mal.	4B	T	5	4	25	109.3							
Sos.	4B	B	5	4	25	99.0							
Total	4B		48	42	5	113.1	103.52	8.14	103.17	6.29	−.35	1.59	.07
Blvd.	4A	K	18	14	7	109.5	107.64	8.19	106.50	7.35	−1.14	2.94	.13
Blvd.	4A	E	11	8	13	118.1	102.10		103.10		1.00		
Blvd.	4A	M	9	9	22	114.6	99.90		101.30		1.40		
More.	4A	B	21	18	33	116.8	102.11	4.63	103.33	4.01	1.22	1.44	.28
More.	4A	D	9	9	22	95.8	103.20		104.60		1.30		
Mal.	4A	D	9	9	22	113.0	96.90		99.10		2.20		
Sos.	4A	B	18	14	21	115.7	100.07	6.16	101.29	5.57	1.22	2.22	.18
Total	4A		95	81	21	112.5	101.99	6.92	102.95	5.97	.96	1.02	.31
Blvd.	5B	E	12	10	20	120.0	102.50	6.81	102.40	8.99	−.10	3.56	.01
Blvd.	5B	S	20	19	5	113.1	105.63	5.54	101.05	5.48	−4.58	1.79	.85
More.	5B	J	14	14	14	106.1	106.00	6.51	105.21	5.67	−.79	2.31	.11
Mal.	5B	D	9	9	11	130.2	96.80		95.60		−1.10		
Sos.	5B	M	7	6	33	102.2	105.70		107.30		1.70		
Total	5B		62	58	14	113.8	103.81	8.74	102.12	8.53	−1.69	1.26	.45

TABLE X (Continued)

COMPARISON OF 1925-26 AQ'S FOR SEPARATE CLASSES

School	Grade	Teacher	No. in Class in 1926	No. in AQ Comparison	% of New Pupils in AQ Comp.	Aver. IQ	1925 AQ's Aver.	1925 AQ's S.D.	1926 AQ's Aver.	1926 AQ's S.D.	1925-26 AQ Diff.	S.D. of Diff.	Exper. Coef.
Blvd.	5A	M	21	18	22	108.4	102.33	3.87	103.33	5.09	1.00	1.51	.22
Blvd.	5A	B	27	26	0	119.0	103.46	8.54	102.88	7.55	−.58	2.24	.09
More.	5A	J	5	5	0	121.2	103.40		105.00		1.60		
More.	5A	H	25	22	27	105.6	101.27	7.88	102.77	8.17	1.50	2.42	.21
Mal.	5A	H	5	3	0	131.0							
Sos.	5A	M	18	16	13	116.8	97.13	8.87	97.00	6.54	−.13	2.75	.02
Total	5A		101	90	13	113.7	101.27	8.02	101.73	7.62	.46	1.17	.13
Blvd.	6B	S	19	16	6	120.4	100.69	9.27	104.69	9.31	4.00	3.29	.41
Mal.	6B	H	10	9	0	106.3	105.90		104.90		−1.00		
Sos.	6B	K	18	16	45	110.2	96.31	9.24	97.38	7.74	1.07	3.01	.12
Total	6B		47	41	20	113.3	100.12	9.45	101.83	8.70	1.71	2.01	.28
Blvd.	6A	W	23	20	20	119.8	97.45	10.10	100.65	10.20	3.20	3.21	.33
Blvd.	6A	H	22	21	14	118.0	98.43	8.98	101.24	10.59	2.81	3.43	.27
Mal.	6A	S	14	13	38	99.2	100.92	7.44	104.31	7.10	3.39	2.85	.40
Sos.	6A	H	27	20	15	113.2	98.60	9.05	101.50	7.37	2.90	2.61	.37
Total	6A		86	74	20	113.6	98.68	9.14	101.74	9.33	3.06	1.52	.67
Total of all Grades			534	461	14	113.6	101.21	8.47	102.52	7.95	1.31	.54	.81
Blvd.	3A+4B	Ph.	19	17	12	118.3	102.35	5.54	104.24	5.43	1.88	1.88	.33
Blvd.	4B+4A	M	21	19	11	115.5	105.32	8.60	102.84	6.18	−2.47	2.43	.34
Blvd.	4A+5B	E	23	18	17	119.2	102.39	5.58	102.72	7.23	.33	2.15	.05
More.	4B+4A	D	16	16	13	96.3	103.81	6.89	104.31	5.53	.50	2.21	.08
More.	4B+4A	B	27	23	26	118.3	101.96	4.99	103.26	4.36	1.30	1.38	.32
More.	5B+5A	J	19	19	11	110.1	105.32	6.97	105.21	6.25	−.11	2.15	.02
Mal.	3A+4B	T	26	22	27	112.5	98.68	6.44	103.32	5.52	4.64	1.81	.85
Mal.	4A+5B	D	18	18	17	121.6	96.88	10.61	97.39	9.70	.51	3.39	.05
Mal.	5A+6B	H	15	12	0	112.5	103.00	8.09	102.17	6.63	−.83	3.02	.09

room. Since such a teacher's work can be more fairly judged when the scores of her two grades are combined in a single measure, these combination averages for the nine teachers are shown at the end of Table X.

Reliabilities of AQ changes were not computed for classes with less than ten pupils represented. If we use the combined group records at the end of Table X and all records for classes of ten or more taught in single grade rooms, 26 teachers are represented. The outstanding fact about the AQ changes for these 26 teachers is that only *two* are large enough to have satisfactory statistical reliability. These are the cases of Teacher H, 3A, More School, with a change from an average AQ of 96.87 in 1925 to one of 105.09 in 1926; and of Teacher T, 3A, Mal School with a change from 98.61 to 103.50. The first of these two groups had the largest total enrollment of any of the classes studied; it has the highest average IQ and the lowest initial AQ of any 3A group. It also has a high percentage of "new" pupils.

If we consider classes where the AQ difference has "good" rather than "perfect" reliability,—that is, cases where the experimental coefficient is between .75 and .97,—we add only two other teachers to the list. One of these is Teacher T, 3A, Boulevard School, with a gain of 4.22 points, from 98.67 to 102.89. The other is Teacher S, 5B, Boulevard, with a *loss* of 4.58 points, from 105.63 to 101.05. Differences for other classes may be noted in Table X and evaluated in the light of their reliability, as the reader sees fit.

In order to evaluate these differences fairly, a number of facts about the conditions of individual classes would need to be known. Certain classes had substitute teachers for periods of a month or more. One teacher had had a class for only the second semester, and the group was badly disorganized when she took charge of it. Another teacher had been handicapped for six months of the year by having to teach in one room forty children of *widely* varying ability and achievement, who in March were divided into two classes. Other similar conditions, which may have tended to reduce AQ gain, may have been unknown to the examiner.

If there are then only four out of the 26 classes in which we can be at all sure that the AQ differences found are fairly reliable, it is obvious that it would be quite unfair to compare the efficiencies of these 26 teachers on the basis of the results shown here. Suppose we try to compare the three 3A teachers whose classes have AQ differences of good reliability. The gains for these teachers were 4.22, 4.90 and 8.22. The

classes differ in size, in percentage of new pupils, in IQ and in initial AQ. It seems to the writer that the only safe conclusion to draw from these data is that these three teachers were probably all doing unusually good work but that it would be unfair to say that one was better than another.

SUMMARY

We will now summarize the findings of the preceding sections, and consider the bearing of the facts found on the following question:— Under what circumstances would it be fair to compare the efficiency of teachers on the basis of AQ change?

(1) Under circumstances prevailing in Shaker Heights, Grade 5 is probably the most difficult grade in which to increase AQ's. Greatest AQ gains were found in Grades 3A and 6A. There may be special incentives applicable in these two grades which are not applicable in other elementary grades. The curricula of these grades may be better adapted to the interests and abilities of the pupils. It is possible that some of the AQ variations from grade to grade may be explained by marked deviations of the Shaker Heights course of study from the "average" course of study used in systems on which the Stanford Achievement Test was standardized. Since such differences are found from grade to grade, it is of questionable fairness to compare AQ gain in Grade 5 with that in Grades 3 or 6. In another system it might be some grade other than the fifth which would be the point of "greatest resistance."

(2) In Grades 3 to 5, a class with a low initial AQ has a marked advantage, as to probability of AQ gain, over one with a high initial AQ. To compare AQ gains of a class with an initial AQ of 109 with those of a class with an initial AQ of 97 would probably give no reliable indication of teaching efficiency.

(3) A teacher who has a class of very high IQ's with low initial AQ's probably has some advantage, with respect to AQ change, over one with a class of lower IQ's. It would often be quite unfair to compare a class with an average IQ of 130 with a class with an average IQ of 90.

Other factors suggested by data from Shaker Heights schools, but not presented in detail in this article, are as follows:—

(4) The annual increase in AQ of groups under a few teachers was found to be due to exceptional gains in one or two of the separate subject tests of the Stanford Achievement Test, accompanied by a slight

or zero gain in other subject tests. If these gains had been made in subjects where improvement was greatly needed, this would have been a desirable result. But in the instances being considered this was not the case, and the result was very uneven progress. The value of an AQ gain based on such a change may have been actually less than one of fewer points which was caused by a more even development.

(5) Data from 38 children who failed of promotion in June, 1925, or February, 1926, suggest that such children, after failure, make slightly less progress than promoted children of similar IQ. Further data need to be collected on this point. At present we may say that a teacher who has in her class any high percentage of pupils who have just failed of promotion is probably at a slight disadvantage. Our data on children who received double promotions yields too few children in each IQ group to allow of any reliable conclusion as to whether their presence in a class increases or decreases ease of making AQ gains.

(6) Care should be taken not to consider a teacher's work inefficient because of losses suffered by her class during her unavoidable absence.

CONCLUSION

Evaluation and comparison of the efficiency of various teachers in a school system should be based on annual AQ change only when teachers have begun the year with comparable groups, and when the differences found can claim high statistical reliability. Some of the factors which make groups fairly comparable, with respect to AQ change, have been mentioned in the foregoing discussion. Others which undoubtedly need to be considered could not be investigated by means of the data available in the present study.

THE RELATIONSHIP BETWEEN THREE DIFFERENT VOCABULARY ABILITIES

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THE close relationship existing between the experience and the size of one's vocabulary is quite obvious. One's vocabulary in a specific field is usually a fairly reliable index of one's knowledge and acquaintance in the field. An analysis of the different group and individual tests, that are being used to test mental ability, reveals the importance of vocabulary ability as it is considered by those devising the various tests. "The possessor of a very limited vocabulary is by this fact alone limited in the extent to which he may profit by the experience of others, since such experiences are, chiefly if not wholly, communicated in terms of words."[1]

The great number of studies bearing on vocabulary abilities are of many different types, involving such topics, as: (1) size of vocabulary; (2) words most commonly found in children's and adults' written vocabulary; (3) word counts from printed matter; (4) the reliability and validity of vocabulary tests; (5) diagnostic and prognostic values of vocabulary tests; and other topics varied in nature.

The present study is an attempt to find the relationship existing between different vocabulary abilities. Sixty-six third-grade pupils were given three tests to find out the different vocabulary abilities. The first test was designed to test a student's ability in choosing words that rhymed. The subjects were given some key words, and then were set to the task of making or selecting words to rhyme with the key words. These key words were *ball, bell,* and *fly*. Two minutes were allowed for each word.

The second vocabulary test was one of word building. In this test the letters a-e-o-b-m-l-t were used. The subjects were given, orally, the following instructions: "Please write at the top of a blank sheet of paper the letters a-e-o-b-m-l-t (these letters were also written on a blackboard in the front of the room). Your task is to make as many words as you can out of these letters given you. You may use any of these letters; but no letter can be used more than once in any one word. Do you now understand what you are to do?"

The next test was a simple sentence vocabulary test, similar in nature to the Holley Sentence Vocabulary Scale, having the same directions but

[1] Arlitt, Ada H. *Psychology of Infancy and Early Childhood,* 1928, p. 176.

containing more words suitable for third-grade pupils. An example of this test is as follows:

To *tap* is to . . . . jump, strike, go, see.

The task of each subject was to underline the word that best completes or aids in making a sentence. All these tests were group tests, given under uniform conditions, and the scoring was especially objective.

Table I gives the correlations found between the different types of tests. The high correlation between ability to find words that rhymed with specified keys and the score made on the vocabulary test reveals that the two are measuring some common ability or are dependent upon a common factor or factors found entering into the results of both tests.[2] The correlation .80 ± .04 between rhyming ability and the vocabulary test score indicates that one can predict the size of a subject's vocabulary with a fair degree of accuracy from a knowledge of the subject's ability in rhyming, as measured by the technique used in this study.

TABLE I

CORRELATIONS BETWEEN SOME VOCABULARY ABILITIES

	Rhyming	Word Building	Vocabulary Test
Rhyming		0.36 ± .07	0.80 ± .04
Word Building			0.38 ± .07
Vocabulary Test			

An analysis of the variability on the three tests shows the students to be very variable on the rhyming test. Table II gives the coefficient of variability[3] for each of the tests. The results of the vocabulary test show very little variability.

TABLE II

VARIABILITY OF THE SUBJECTS ON THE THREE TYPES OF TESTS

	Rhyming	Word Building	Vocabulary Test
Coefficient of Variability	.386	.224	.114

A further analysis of the data was made with respect to sex differences. The group was composed of 35 girls and 31 boys. There was no reliable sex difference found. On the rhyming test the girls were 7.5 percent higher, while on the vocabulary test the boys were 2.3 percent higher. On the word building test there was a difference of 1.1 percent in favor of the girls.

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[2] One cannot conclude from a high correlation alone that causation exists.

[3] Coefficient of variability was found by formula: $C.V. = \frac{100\sigma}{\text{Average}}$

Some conclusions and further studies suggested from this observation are:

(1) There is a positive relationship between the three vocabulary abilities tested, the highest being between the rhyming and the vocabulary test score.

(2) The subjects showed an unusual amount of variability on the rhyming test with the least amount on the vocabulary test.

(3) There is no reliable sex difference found for the three vocabulary abilities. In the case of rhyming the average score of the girls was 7.5 percent higher than the average of the boys.

(4) Further studies showing the relationship between age and grade and each of these vocabulary abilities would be of interest as well as of value.

(5) Further studies of the prognostic values of these tests would be of immense value from the standpoint of guidance.

PREDICTIVE SIGNIFICANCE OF THE CORRELATION COEFFICIENT

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ONE of the most common uses of the correlation technique has been the attempt to predict scholastic success by means of tests. There has been much discussion as to the proper interpretation of the correlation coefficient in such predictions. One of the recent writers[1] has endeavored to show that satisfactory prediction is impossible with the present measuring devices. He says:

"*It is doubtful whether any prognostic test even has risen consistently above an efficiency of 30 percent.* It is always hazardous to predict a limit beyond which science cannot attain, but the present indications are that unless some more or less radical improvement in test construction is discovered, psychological tests will be forever doomed to operate at an efficiency under 50 percent, probably under 40 percent, and very possibly the average efficiency will not rise much above 25 percent or 30 percent."

While much work has been done in this field, very little attention has been given to probable causes of the failures to secure better prediction.[2] In most cases the criterion of scholastic success has been the teachers' marks. While the unreliability of teachers' marks has long been a topic of discussion among research workers, there has been practically no effort to determine the effect of this unreliability upon possibilities of prediction. Workers generally have neglected to consider the fact that lack of prediction is due to both the lack of agreement and the unreliability of the criterion.

If, as is usually done, X_1 (the obtained score of the criterion) is taken as evidence of X_∞ (the true score of the criterion), $(X_\infty - X_1)$, is the error of estimate and the standard deviation of such errors[3] is $\sigma_1\sqrt{1-r_{11}}$. If we set $\sigma_1 = 1$, the error of prediction of true scores is $\sqrt{1-r_{11}}$. Since the errors plus the successes equal 1, the predictability of the criterion may be measured by the equation $P = 1 - \sqrt{1-r_{11}}$. The practicability of the criteria of varying degrees of reliability is given in Table I.

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[1] Hull, Clark L. "The Correlation Coefficient and Its Prognostic Significance," *Journal of Educational Research*, XV, (May, 1927), pp. 327-338.

[2] For exceptions see Wood, Ben D. "Measurement in Higher Education," and Symonds, P. W. "Measurement in Secondary Education."

[3] Kelley, Truman L. "Interpretation of Educational Measurements," p. 180.

TABLE I

PERCENT OF PREDICTABILITY FOR SPECIFIC RELIABILITIES

Reliability of Criterion	Percent of Predictability
.99	90
.98	86
.95	78
.90	68
.85	61
.80	55
.75	50
.70	45
.60	37
.50	29
.40	23
.30	16

Since the reliability of teachers' marks is rarely above .75, only occasionally can they be predicted with greater degree of accuracy than 50 percent. The proof of this statement is simple. Except by chance, nothing can correlate higher with any variable than the square root of its reliability coefficient.[4] If $r_{11} = .75$ the maximum correlation is .866. Using Hull's measure of efficiency, $e = 1 - \sqrt{1 - r^2}$ we have $e = 50$ percent. It seems likely then that the failure of tests to predict scholastic success may not be due to defects of the tests as much as to the impossibility of predicting the criterion due to the unreliability of the criterion.

If the divergence of prediction were measured from the true scores of the criterion, the error would be much less. This divergence is measured[5] by $\sqrt{r_{11} - r^2_{12}}$ in which r_{11} is the reliability of the criterion. and r_{12} the correlation of the test with the criterion. By comparison of $\sqrt{1 - r^2_{12}}$ and $\sqrt{r_{11} - r^2_{12}}$ the percent of error in prediction that is due to the unreliability of the criterion may be determined. Table II illustrates the amount of error that may be due to this cause.

TABLE II

THE PERCENT OF ERROR IN FORECASTING DUE TO UNRELIABILITY OF THE CRITERION

Correlation between Test and Criterion (r_{12})	Reliability of the Criterion $r_1 = 90$	80	70	60	50	40
.90	32					
.80	15	33	60			
.70	10	21	35	54	99	
.60	9	18	28	39	54	75
.50	7	15	23	32	43	55
.40	7	13	21	28	38	47

Note: The above table should be read as follows: When r_{12} is equal to 90 and $r_1{}^1$ is equal to 90, the percent of error in forecasting due to unreliability of the criterion is 32; when r_{12} is equal to 80 and $r_1{}^1$ is equal to 90, the percent of error in forecasting due to the unreliability of the criterion is 15, etc.

[4] Kelley, Truman L. "Statistical Method," p. 206.
[5] Kelley, Truman L. "Statistical Method," p. 214.

In cases where a number of factors are used by multiple correlation, it is probable that most of the failure of prediction is due to unreliability of the criterion. For example, Flemming[6] finds a multiple correlation of .84 with high-school marks. If we estimate that the reliability of the marks used was .75 (a generous estimate)[7] we find that the efficiency of prediction is $1 - \sqrt{1 - (.84)^2}$ or 46 percent.

On the same assumptions the efficiency of estimating true scores of teachers' marks is $1 - \sqrt{.75 - (.84)^2}$ or 80 percent. If we assume the best possible prediction, the multiple correlation coefficient would be $\sqrt{.75}$ or .86, which gives a predictive accuracy of 50 percent. Under the conditions stated the maximum improvement in prediction is only 4 percent.

It may be concluded that before there is any marked improvement in predictive values of tests, there must be an increase in the reliability of the measures of scholastic success. The present need is not a "radical improvement in test construction" but a radical improvement in the measures of scholastic success. If the criteria of scholastic success were as reliable as the present psychological tests, it is probable that prediction would be satisfactory in three cases out of four. Our knowledge of the causes of prediction failures is now sufficient to make it necessary that in all predictive studies workers should know and take into consideration the predictability of the criterion.

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[6] Flemming, C. W. "A Detailed Analysis of Achievement in High Schools."
[7] Flemming estimates the reliability of her criterion as .70.

EDITORIALS

THE ACTIVITIES CURRICULUM

There has grown up in this country and abroad also two fundamentally different notions of how best to organize subject matter for teaching purposes. According to one conception of teaching the best method of training boys and girls is to set them to the mastery of logically organized subject matter, such as is found in textbooks, reference books, and lectures. According to another notion the best method of training boys and girls is to set them to the thoughtful performance of various activities, such as the making of miscellaneous objects, participation in self-government, and the development of creative projects of various sorts. Lying between these extremes are all kinds of plans, some representing more and some less, of one or the other of these concepts of teaching. The drift seems, however, to be in the direction of the activities curriculum as a means of securing thoughtful participation by pupils to the end that usable knowledges, skills, and attitudes may be developed. The change is one of considerable importance, and needs careful consideration.

Four criticisms have been made of the traditional curriculum: (1) It fails to stimulate pupils' interest. Learning under the traditional system of instruction is dull and uninteresting. Pupils are driven and over-supervised. (2) Pupils fail to retain facts thus taught. Critics of the traditional curriculum point to the low scores on standardized tests and the rapidly falling curve of forgetting as evidence of the failure of this method of instruction. (3) The critics of the traditional curriculum assert that logically organized subject matter does not function in life. To overcome this weakness special attention has been given by the best teachers of this method to applications and the special uses to which the information taught pupils may be put. The critics, however, have not been satisfied by what they consider artificial applications. (4) They point out, also, the danger of a mere *verbal* education. Pupils understand only partially the symbols which they use. It would seem theoretically possible, at least, for pupils to build up an extensive

vocabulary and a degree of verbal glibness without getting a fundamental grasp of the problems and tools of life. Because of these alleged shortcomings in logically organized subject matter, and because of the promise which is held out by the activities curriculum, many people have come to feel that the advantage lies in the direction of the activities curriculum.

There are, however, certain limitations to the activities curriculum program, especially as worked out in practice, that should not be overlooked: (1) There seems to be a tendency on the part of classroom teachers to limit the activities curriculum to learning by doing, in its more restricted sense. Learning by doing, notwithstanding its effectiveness, is a very slow method of learning, because of the natural restrictions of time, place and materials placed upon it. It would seem, after the fundamental experiences have been provided pupils through direct participation, that it would be educationally more economical to provide for directed observing, writing, reading, and thinking, to supply the additional experiences which underlie the organized curriculum. There are four ways of getting experience: (a) through direct participation, (b) observation, (c) reading and oral report, and (d) reflective thinking. There is a tendency among teachers to take a narrow view of the activities curriculum.

(2) There seems to be much misunderstanding about interest and the activities curriculum. This is not a new idea. Many teachers, however, take the demand for interest to mean that teachers should be entertainers to amuse pupils. While this notion of interest is quite foreign to the one intended, there has doubtless been a general lowering of standards because of it.

(3) Many teachers fail to provide practice in analysis and generalization. To them the activities which constitute the curriculum become an end in themselves. There is plenty of activity, but to no conscious goal. It would seem from general observation that it is not the amount of experience which differentiates the training of individuals, but the amount of *analyzed* experience which counts. Should this observation be true, it would be quite possible to have activities instruction of a very low level of effectiveness.

(4) Teachers fail to provide for the progressive reconstruction of experience. The organization element which was particularly strong in the traditional curriculum is quite lacking in the average activities program. The activities stand isolated, unanalyzed, and unorganized.

There is no building up from these activities of a system of knowledge —granting that such is desirable. The objection to the traditional curriculum, as I understand it, was not to its systematized knowledge but to the insistence of teachers upon teaching it directly from text-books, references, and lectures. In practice the activities curriculum has failed to bring to pupils an organized view of life.

(5) Teachers fail to provide for the repetition of experiences where repetition is necessary. It seems to me that the objection to drill as originally made was not to drill itself but to unmotivated drill, that is, to drill disassociated from the activities of life. It does not seem economical to leave the matter of habit formation to chance associations and incidental learning as seems to be the case with so many teachers who purport to use the activities method.

I have had in mind in this editorial two thoughts. There is in progress in this country a fundamental movement for the reconstruction of the curriculum. In the first place, this movement for the reconstruction of the curriculum is important, but based for the most part upon theoretical considerations. While these considerations seem sound enough, it is only reasonable to suggest that they need careful evaluation. The history of education is replete with fallen projects, all of which appeared promising enough at one time or another. In the second place, the author is tremendously interested in the activities curriculum, and regrets very much to see the limitations placed upon it in so many of our public schools. The limitations here cited are, of course, really not limitations in the method itself, but misconceptions of the plan as observed in practice. The idea is one of too much promise not to have it live up to what is expected of it.

A. S. B.

REVIEWS

Address all communications relative to book reviews to Editor E. J. Ashbaugh, Miami University, Oxford, Ohio.

FARLEY, BELMONT MERCER. *What to Tell the People About the Public Schools.* Teachers College, Columbia University. Contributions to Education, No. 355, 1929. 136 pages.

The purposes of this study are threefold; namely, to find what school news topics are of most interest; to find out what school news topics are being most extensively treated in present school publicity; and to prepare chief topics of school publicity. The data for the first were secured from responses of 5,067 randomly selected school patrons in thirteen cities, for the second a topical analysis of nearly 40,000 column inches of school news appearing in 737 issues of ten newspapers published in ten different cities, and for the third approximately 2,000 school news stories selected from a wide range of sources.

At the outset the field of school news was divided into thirteen main headings such as attendance, courses of study, methods of instruction, etc. These thirteen topics were distributed among a selected group of patrons, who were asked to arrange them in the order of their interest. On the basis of their return it was found that pupil progress and achievement ranked first, methods of instruction second, health of pupils third, and extra-curricular activities thirteenth. The replies from the patrons of each city were correlated with those of each of the other cities. The uniformity of interest in each of these topics in the different cities is well shown by the correlations, the lowest of which was plus .85 with no negative coefficients.

In the second phase of the problem, "What the People Are Being Told About the Public Schools," an analysis was made of almost 40,000 column inches of school news appearing in 737 issues of ten newspapers published in the cities in which the inquiries to patrons were made. This material was distributed among the thirteen major headings into which school news was divided. On this basis extra-curricular activities ranked first on the amount of newspaper space devoted to this topic, teachers and school officials second, and parent-teacher associations third. Pupil progress and achievement and methods of instruction which were ranked first and second by the patrons ranked fourth and tenth respectively on the amount of space in the newspapers studied.

In the third phase of the problem, "What to Tell the People About the Public Schools," two thousand news stories and articles were selected and from these an attempt made to secure an illustration of every topic of school news offered in the source canvassed and to classify these topics under the thirteen headings of major school news. It was the intention of the author to have this constitute a guide to educational topics which ought to be covered in school news. Due, however, to the fact that fifty-five pages of material are required to present

these illustrations for four of the major topics, it is doubtful whether it is of much value for the purpose designed. If the same amount of space were taken for each of the other nine headings it would require at least 175 pages for these illustrations and would be so voluminous that its value for the purpose intended would be doubtful.

Assuming that our school news program should take cognizance of the interest of patrons, this study is significant in pointing out the wide difference between patrons' interest and the school news which actually finds its way into the newspapers.

T. C. HOLY

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MYERS AND HARSHMAN. *Training Secondary School Teachers.* Cincinnati, Ohio: American Book Company, 1929.

This is another of the numerous observation manuals published in recent years,—in this instance a manual to be used by students of secondary education. The manual is less comprehensive than the earlier one by Myers and Beechel. The topics treated are limited to the physical equipment of the school, school organization and management, and to the technique of teaching. The inclusion of the seven units of study for the purpose of acquainting the observer with such questions as the organization of the school, extra-curricular activities and their place in the education of children, the principles of school and class management, pupil-teacher relationships, etc., is highly commendable. In this manner students should get a broader appreciation of the educational significance of the school than would be the case if observation were confined to the technique of teaching.

The directions for observation of the technique of teaching are somewhat disappointing to the reviewer. They would necessarily vary in value with the reader's philosophy of education. Even from the point of view of the authors, however, it would seem that the directions could have been made much more helpful. A more complete analysis of the technique which the teacher uses would in a number of cases, have greatly benefited the observer. Thus, in the study of aims it would seem that the significant thing to look for is not merely the presence of general and specific aims and the relationship of these two, but how aims function in the course of a class discussion. Questions bearing on: the function of the aim in the conduct of the discussion, in pupil and teacher relationships, in the manner of carrying on the work, in the spirit of the school room, etc.; how aims control the selection of subject matter and the choice of pupil activities; the manner in which the teacher uses both subject matter and pupil activities to attain her objectives should have been inserted. These are only implied in Direction IV in which the student is asked to "prove that the specific aim was or was not accomplished." A similar criticism could be made on the units of Motivation, Lesson Assignment, Problem Solving, and others. As an attempt to solve the very difficult problem of introducing the prospective teacher to the problems of teaching in as effective a manner as possible, the manual renders a distinct service to all who are seriously interested in this problem.

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LATON, ANITA DUNCAN. *The Psychology of Learning Applied to Health Education Through Biology.* Bureau of Publications, Teachers College, Columbia University, 1929. vi + 103 pp.

This is a valuable book by means of

which instructors in biology may learn how this science can contribute to health education. It is an account of techniques developed and results obtained through an experimental application of the facts and principles established in the psychology of learning. The experimental class and the control group referred to by the author were composed of comparable ninth-grade pupils carrying biology in the Lincoln Junior High School, Teachers College, Columbia University. The unit of communicable diseases was chosen for both groups with the aim of developing knowledge of ways in which diseases may be prevented.

The first part of the book includes a comprehensive table of contents giving full chapter headings, sub-titles, and also other statements. The make-up is satisfactory; each item is stated clearly. It also contains an indispensable introduction which tells the nature of the study about which the book was written. Detailed information is given regarding the two groups. The reader learns how the principles of the psychology of learning were used as the most important guide in the choice of objectives, subject matter, and classroom procedure with the experimental group. Teaching procedures of the control group were as nearly as possible those of common practice; no conscious effort was made to apply the principles of psychology.

One regrets having thirteen pages given to the description of "experimental" group and "control" group inasmuch as the book is written for persons who know under what conditions exact experiments are conducted. One wishes that the author had given more space to that which is unique.

Valuable information is given with the description of the procedures which were used with the experimental group. The reader may learn methods which would prevent the error of expecting students to possess concepts in relation to which they can have no concrete experience. The writer tells how students were helped to direct their own study and organize their own ideas and yet not waste time on concrete experiences leading to concepts which they already possess. She emphasizes the importance of having the teacher's "mind-set," so as not to lose sight of objectives.

The second part of the book indicates that material with health education value can enrich biology. The last part considers tests which were given to evaluate the results of teaching. It also contains an up-to-date bibliography which will help readers who want more information on the problems to which the author refers.

Tests were given to the experimental and control classes, and also to a thousand comparable children in other schools. The experimental class showed greater knowledge of important preventive measures for communicable diseases while the control group could not recognize such in the multiple-choice tests. The tests also indicated some of the contributions which the teaching of biology is making to health education. Results of the tests indicate advantages derived from teaching with consideration of the principles of psychology.

Books on health education are for the most part theory. This book is, therefore, unusual because it reports what was accomplished. It can be used as a guide by all who aim to teach health education while teaching complex subject matter. Moreover, it gives the reader the methods of applying the psychological principles of learning, including such teaching situations as interest, use, analogy, satisfaction, identifiable elements and recency. It

also contains an abundance of useful material which is endorsed by present day leaders in the field of preventive medicine.

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WHITNEY, FREDERICK L. *Statistics for Beginners in Education.* New York: D. Appleton and Co., 1929. xvi + 123 pp.

This little volume is very well named. For the most part it is really a presentation of statistical methods in an elementary way, and should be of value to students who have no knowledge of methods of obtaining and handling statistical data. To an unusual extent the author has taken the results of actual situations and used the narrative form of showing how the data were obtained, treated, and interpreted. This method of presentation is usually more interesting than a purely mechanical treatment of abstract, detached numbers for illustrative purposes.

The first chapter is devoted chiefly to physical, mental, educational, and age differences between pupils. The second chapter shows some of the elementary but important methods of securing statistical materials, and the third is given to methods of organizing, and classifying them. The best part of the book seems to be on the matter of graphic presentation. This topic is taken up in the fourth chapter, and various methods are illustrated and discussed. Also in the first chapter graphs are used freely in showing individual differences relative to various traits and subjects.

The last three chapters are devoted more specifically to methods of computation, but the topics included are treated too briefly and inadequate. For example, in showing how to compute the mean the author's illustrations are too meager and incomplete. With the class interval he gives only the mid-point-frequency method. This, of course, is not the least cumbersome, nor the most widely used method. Likewise, very little is given on the median, quartile deviation, and standard deviation. A student who has had a half year's work in statistical methods might refresh his memory by referring to these illustrations, but an inexperienced student would need a more elaborate explanation of each subject.

In the seventh chapter the measure of relationships is treated more fully, but, out of keeping with the general level of the book, the author brings in partial and multiple correlations, which would hardly be taken up by beginners in statistics. This seems too much like including a little material from trigonometry or calculus in a beginner's text in algebra.

The book, like many others in statistical methods, is lacking in examples, problems, and exercises. It would seem that any beginner's book in this field should be constructed very much on the same general order as a text in arithmetic, algebra, etc. In other words there should be an abundance of examples and explanations of the various measures, followed by a sufficient number of problems and exercises to develop a high degree of efficiency and skill in the application of the formulae most generally used in the scientific treatment of objective data.

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Syracuse University

SHEPARDSON, WHITNEY H. *Agricultural Education in the United States.* New York: The Macmillan Company, 1929. viii + 132 pp.

This neat little volume of eight chapters appears as the latest contribution to the "literature" of agricultural education. It is the report of a "lay study" of agricultural education in the United

States undertaken under the auspices of the Education Board. It is well written. The contents clearly show painstaking labor in digestion of massive volumes of "proceedings" and reports. They show, too, the influence of long interviews with "agricultural scientists" and college deans. Nevertheless, the truth of the author's modest confession that he "knows very little about education, and nothing at all about practical agriculture" is thoroughly demonstrated.

On the side of narrative and description the deficiency is in nowise a handicap. The presentation of "backgrounds," status, and trends of institutional development in the agricultural divisions of the Land-Grant colleges, to which much of the volume is given, is very well done. That phase of agricultural education fostered by the Federal Act for Vocational Education is treated in cursory—almost cavalier fashion. But the author is right in his emphasis upon the college "at the center of the system, whether viewed structurally, functionally, or historically." To the agricultural college he devotes first attention throughout. Descriptively he differentiates accurately its functions of research, resident instruction, and extension; critically he confuses them hopelessly.

The strongest feature of the book appears in the argument for unhampered and scholarly research. About it there is nothing new to those familiar with the views of scientists and certain administrators. Rarely, however, has it been put forward with greater lucidity. At the end, perhaps, it verges upon special pleading for the "fundamental" plant sciences—a fact not astonishing to one who has read the list of "educators" consulted in the study.

The weakest feature of the book lies in the confusion of scholarship for the advancement of knowledge with scholarship as a means of preparation for varied services of leadership in rural affairs. Of course, the identification of scholarship with education, as is usual with laymen and scientists, forces the argument for curricular reform and higher standards back upon the disciplinary theorem, which carried to its logical conclusion for education—not for research—points to the elimination of differentiated institutions for resident instruction at the college level. In consequence the "somewhat unconventional idea" of Doctor Rose "that a layman without professional training and without institutional loyalties, might produce some useful ideas" proves unfruitful in the constructive phase of the report. Careful and well presented as the study appears, it seems to your reviewer, at least, but another of the multitudinous instances in which, dealing with a problem of education, the writer has neglected to inquire into the nature of educational aims and the meaning of the educational process. It is a pity that so painstaking a student and so clear a writer as Mr. Shepardson did not include among the many volumes he must have perused, one dealing with the principles of education, or among the scholars he consulted one whose scholarship lay in the theory of education.

T. H. EATON
Cornell University

KLAPPER, PAUL. *Contemporary Education, Its Principles and Practices.* New York: D. Appleton and Company, 1929. xxv + 660 pp.

The purpose of this work, as stated in the preface, is: ". . . to coördinate the accepted principles of social and psychological studies and to indicate their significance for education to-day. . . . to evaluate contemporary practice in the light of those principles . . . to give the

student an insight into scientific method . . . to encourage students to react critically to the content studied and to crystallize the fruits of their own thought.'' In regard to use, the purpose is to furnish ''a helpful teaching instrument in the introductory or orientation courses in education, as well as in existing courses in principles of education.''

The content seems to be quite largely a revision and expansion of the materials in the same author's *Principles of Educational Practice*, the copyright of which goes back to 1912. A comparison of the two volumes will give some future historian a very good view of ideas and practices which came to the fore in American education from 1912 to 1929.

In the new work the idea of adjustment is still the central theme; but the aspects considered are physical, social, economic, and mental—as compared with physiological, sociological, and mental in the earlier book. Much new material is introduced, and the organization is changed in some particulars, as, for example, the switching of manual training and vocational education from ''Education as Physiological Adjustment'' in the old work to ''Education as Economic Adjustment'' in the new.

The organization of materials is in general clear, logical, and well shown by section headings. Parallel columns are often used to bring clearness when ideas are to be compared or contrasted. The student is led to an organization of his own ideas by exercises placed at the end of each chapter.

The amount of space to be devoted to the various items in a work as large as this presents a very difficult problem, and any criticism is likely to be somewhat unfair. Still it seems strange to allow programs in health education two chapters with a total space of about forty pages while mental hygiene is given less than ten pages; to give five pages to the culture epoch theory and none to the improvement of the written examination; to use about three pages explaining the inheritance of blackness and whiteness in guinea pigs and yet omit any systematic discussion of the interrelations of schools and other institutions.

The readings which accompany the various divisions of the book have been selected with care and intelligence. In addition to a detailed table of contents an excellent index is provided.

In spite of the author's attempt to utilize only principles that are generally accepted as sound, even a mildly critical reader will find many statements with which he cannot agree. The following, taken from the first few pages, are examples:

''It [the state] is only as strong as its weakest constituent link.'' p. 4.

''The supreme force in human life is reason.'' p. 13.

''The actual life of the pupil is the ideal curriculum.'' p. 19.

''It [a modern society] is as much an organic whole as a human being.'' p. 30.

C. L. ROBBINS
State University of Iowa

NYQUIST, FREDERICK V. *Art Education in Elementary Schools.* Baltimore: Warwick and York, Inc., 1929. 160 pp.

This is an interestingly written discussion of Art Education in the Elementary Schools, and since art education has so long been regarded as an out-of-the curricula study, it is refreshing to find a modern thinker who considers it as being equal in importance to the traditional three R's of other generations. Professor Nyquist has divided his book into five brief chapters, and each chapter contains a surprising amount of new material and

the most pertinent thoughts of the writer's on art since Froebel and Pestalozzi.

Chapter One is a discussion of the historical aims of elementary art education, classified under the three heads: cultural, pedagogical, and economic. The early Greeks recognized and practiced these cultural aims, but art education did not receive special pedagogical emphasis until the advent of the natural educationists of the seventeenth and eighteenth centuries, who discerned the extensive possibilities of art in learning.

The writer believes modern elementary curricula will recognize five functions of art instruction in current objectives: communication, observation, construction, selection, and appreciation. Art functions along two different lines; namely, art as language and art as beauty. These current aims are further developed by the author into specific objectives which carry through from elementary school to adult life. Quotations from "How to Make a Curriculum," by Bobbitt, explain these recognized values of drawing for communication, observation, construction, selection, and appreciation. According to the author, "vocational selection in art may also be classified under these aims."

In Chapter two the scope of elementary art education is outlined under the five objectives stated in the previous chapter. The tabulations on pages fifty-three to fifty-eight tend to decrease the excessive emphasis formerly placed upon drawing in the public schools and to curtail the manipulative activities of the children.

In Chapter three the author declares that the idea of the standards in art education has been dictated by the professional art school. He also decries the tendency to use professional art school methods in the public schools. Compositional drawing and free expression are a part of the content of the art courses over the country to-day, and are being used in a valuable way. The plan suggested of teaching representational drawing before composition is logical, just as content is placed before form, and line drawing before tone. Lettering as a phase of art education is emphasized in the art curriculum, mainly because of the importance of advertising, and also of the value of beautiful spacing unity.

The author seems to understand the misuses of construction, a type of art now taught only in the special schools for subnormal children. He is discriminating in this study of design in relation to the economic and decorative needs of society. Design and ornament and color occupy a very important place in everyone's life, for choices of wearing apparel and furnishings for the home are a part of everyone's experiences. The study of dress and of interior and exterior home-decoration makes the child more sensitive to the esthetic arrangement of dress, the home, and landscaping.

Chapter five deals with selection and art appreciation. These prove to be the main essentials of art in education. According to the author, however, "the word appreciation as used in educational discussion to-day connotes a wide and many sided significance. Its usage is applied to the appreciation of character in human nature and the appreciation of works of art." The development of an individual's life is dependent upon selection and appreciation. With further and directed study these abilities may be developed until each individual is sensitive to the feeling of finer line, tone and color.

This book is needed in art education. It sets forth its principles definitely and interestingly. It tells in a concise and unusual way the essentials of art as a subject of relative importance in the

school curriculum, along with the other subjects, and is written in a style that is stimulating and readable.

Miami University AMY M. SWISHER

McDONALD, PHILIP B. *English and Science.* New York: D. Van Nostrand Co., Inc., 1929. vii + 192 pp.

This book attacks the problem of composition in a thoroughly sensible and helpful way. It begins with the following quotation: "There must be first of all a complete understanding of the subject matter, so that a man is utterly and completely at home in it. Then there must be the constant realization of the fact that what has become second nature to the speaker is utterly strange and unfamiliar to his audience." As to the basic requirements of technical writing, it goes on to remark with directness and candor "that much of the old fashioned rhetoric and composition taught in our schools and colleges encourages verbosity and tolerates vague, stilted language," and that "in the following pages, the principles of simplicity and conciseness have been given first consideration." There are excellent passages on the necessity for careful study of one's audience (pp. 11-13; pp. 23-24). This was thoroughly and excellently treated in Aristotle's Rhetoric, but has somehow been lost to sight since. That it is the key to success in explanation, anyone who has ever learned to explain knows perfectly well; that it has had no effective consideration in texts and courses of study is incomprehensible.

There are good passages on the revising and examining of sentences (pp. 15-18), and advice on getting rid of orateness and pomposity, (pp. 96-9). Chapter VI (pp. 83-9) makes a valiant and useful attack on such stupidities of purism as the objection to the split infinitive, on over-niceties of pronoun references, and the like. In short, the purpose of the whole book is well summed up in the statement that "the major principles of composition are clearness, simplicity, conciseness, and informality."

It is disappointing in so excellent a plan to find that the writer fails to give definite help in several places where it is most needed. In spite of all his good insistence upon careful planning or prevision, he has nothing to offer here as a scheme or framework save the outworn and valueless "introduction, body, and conclusion"—which are no organization, since it is the body that must be organized, and, generally the appurtenances may simply be cut off.

In the face of his valiant attack on purism, Mr. McDonald tells us (p. 17) that "Grammatical and rhetorical principles, as explained in any good handbook of composition, should be kept in mind." This is simply handing over the citadel so hardly won to the same absurd enemy! He is right in saying that "most amateur writers over-use capitals," but surely wrong, both in his own use above and in his precept, when he goes on: "hyphens should be freely used . . . One mark of a careless or poorly-educated writer is his disregard for hyphens" (p. 21).

In short, here is a book with much of specific and definite value for the business or professional man on that laborious art—the composition of practical, simple English.

Where the writer breaks most fully with tradition, he is invaluable in his clarity and common sense. There are some excellent matters in the chapters on sentence structure, punctuation, and the like. One could only wish he had gone a bit farther in driving out the ghosts of scholasticism and purism, par-

ticularly in the matter of helping us organize what we have to say not only logically, but, as he clearly tells us, psychologically or rhetorically as well, for the clear understanding of the particular hearers we are addressing.

S. A. LEONARD
University of Wisconsin

WOODRING, MAXIE N. AND SCHWENDENER, NORMA. *Enriched Teaching of Physical Education in the High School.* New York City: Teachers College, Columbia University, 1929. ix + 143 pp.

This volume is one of six source books for teachers of specialized educational programs. Their object is to provide fairly complete bibliographies for field workers who are anxious to "increase the range of (their) activities and assure broader and richer concomitants of learning."

"Enriched Teaching . . ." lists some eight hundred sources under twenty carefully thought out headings. The headings are: Apparel, Athletics, Bulletins-Pamphlets-Outlines and Handbooks, Camping, Costumes, Dancing and Rhythms, Dramatic Expression and Creative Activities, Equipment and Supplies, Excursions, Festivals and Pageants, First Aid, Health and Hygiene, Music, Pictures-Posters-Charts and Slides, Professional Reading for the Teacher, Magazines and Periodicals, Recreation, Summer Activities for Teachers, Professional Associations, Tests and Measurements, and Index. The subjects receiving the most space are Athletics, Dancing, Pageants, and Professional Reading.

Each source reported is described briefly, the address of the publisher is included and wherever possible prices are quoted. Many free materials are listed.

A few weaknesses in this source book, which is really an annotated bibliography, should be noted.

The number of pages in the sources listed are omitted. There is no heading under which corrective activities may be brought together, nor are many such books included under other headings. There are but few titles on the various special systems of gymnastics. Several important titles are missing, too, and the sub-heading "Magazine Articles" should have been made more inclusive or omitted altogether. The authors also repeat the common error of describing their material as for "teachers of physical education." What they mean is, of course, teachers of physical *activities*. One "teaches physical education" to prospective teachers of physical activities.

This compilation of material is apparently only fragmentary; it could hardly be otherwise. It is, nevertheless, well-arranged and annotated; doubtless it will provide a valuable guide to literature in the field of physical education for teachers, most of whom cannot reach well-equipped libraries and must purchase whatever they read.

FREDERICK RAND ROGERS.
New York State Department of Education

WHEAT, HARRY GROVE. *The Relative Merits of Conventional and Imaginative Types of Problems in Arithmetic.* Teachers College, Columbia University, Contributions to Education, No. 355. 123 pp.

In 1925, Myers published his *The Prevention and Correction of Errors in Arithmetic.* A section of this booklet was devoted to reporting the results of a study of "how problems designed to stimulate vivid imagination compare in difficulty with very similar problems of

the dry, concise, traditional sort." (p. 65) Myers' data indicated a rather marked advantage for the problems designed to have an imaginative appeal. Recently published textbooks show a tendency to word problems in a lengthier (a presumably more attractive) manner and contain many more pages for each grade than do the older texts.

Doctor Wheat's dissertation is a report of the results of an experiment designed to determine the advantages, if any, of imaginative problems over those of the conventional type.

Five series of tests were used. Problem Test I contains ten pairs of problems, one member of each pair being an imaginative problem and the other a conventional one. Problem Test II is a repetition of the Myers' test. The third series are called Collateral Tests and include the Burgess Scale for Measuring Ability in Silent Reading, the Otis Self-Administering Test of Mental Ability, Intermediate Examination, selected parts of the Cleveland Survey Arithmetic Tests, Form 1, and the Stone Reasoning Test, Form 1. Problem Test IV is a repetition of Problem Test I, except that the conventional problems of Test I are expanded to show more clearly the mathematical relations involved. Problem Test V is composed of two parts, Part A containing ten short conventional problems and Part B composed of ten longer imaginative problems.

The results fail to show any significant advantage for the imaginative problems. The author states that "pupils of the intermediate grades are neither hindered nor helped in their problem practice exercises by problems of the imaginative type, when no limits are imposed upon the amounts of time of their practice periods" (p. 62) and that "while the pupils—may be expected to be helped in certain instances by the longer conventional type of statement of problems, the amount of such helpfulness in any case is largely a matter of chance." (p. 78).

When time limits are imposed, the conventional problems are superior. More practice can be gained in a given unit of time. "The degree of superiority in a given case does not appear to be related to the pupil's standing in reading ability, in intelligence, in carefulness of work, in arithmetical reasoning, or in ability in the fundamentals." (p. 105).

The book is well organized and well written. The reviewer, however, became a little weary at times because of the excessive space taken to state and interpret results. Its 123 pages could probably have been compressed into 75 without loss of comprehension or interest on the part of the reader.

Some minor statistical irregularities mar the book slightly but do not detract from the soundness of the conclusions. Correlation coefficients are stated both with and without probable errors. Two decimal places are used to express *r's* while the *P.E.'s* appear both as two-place and as three-place decimals. Graphic representations of frequency distributions are said to fit closely superimposed normal curves but no measures of closeness of fit are employed. Furthermore, two of the empirical graphs seem to be rather markedly leptokurtic while fairly marked positive skewness seems to be present in two. One is both leptokurtic and positively skewed.

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Students of arithmetic will be much interested in Doctor Wheat's study. Authors of textbooks will scan its pages with especially keen interest. It is a worthy contribution and a challenge to

others concerned with the scientific study of problems of learning in this subject.

R. L. MORTON

Ohio University.

TILSON, MARIE AGNES. *Problems of Preschool Children as a Basis for Parental Education.* New York City: Teachers College, Columbia University, 1929. ix + 90 pp.

The main purpose of the present study was the discovery of problems that arose in the rearing of 225 American born children between the ages of one and five years who were referred for one reason or another to one of the seven habit clinics from which data were secured. (It is explained that the word "problem" is used throughout the study to designate any condition about which the parents either desired or needed help to promote the health and adjustment of their children). Other purposes were the further discovery of the relation between problems and chronological ages and mental levels of the children; relation between the problems and the nationality, educational training, religion, and occupations of the parents of the children and the rating of their homes; and the relation between the problems and the number of children in the family and the age position of the problem child in the family. Opinions of specialists concerning the importance of parents' attitude toward and manner of dealing with their children were also secured.

After a brief "historical survey of habit clinics" for children in the United States (Chapter II) conducted by the state, county, city, and private institutions, the author devotes at least two-thirds of the book to "an analysis of data concerning the problems referred to the habit clinics" (Chapter III). This chapter gives a most complete enumeration of items or problems together with their frequencies. Then follows 58 tables which treat of these data in every conceivable manner. Chapter IV presents many quotations from specialists on "the influence of the home on children's problems." The last chapter deals with the "summary and findings" generally required when material is used for purposes of the doctoral dissertation.

Doctor Tilson has done a good piece of work. The tables found in Chapter III will serve as excellent source material for students of the preschool age. Of special significance is the location of problems on the half-year basis. For example, the greatest number of temper tantrums occur between the ages of 3-3½; food problems between the ages 2-2½; poor nutrition between 2-2½, and speech problems between 3-3½. Other items of special interest are the mental level distributions for all of the age distributions for the various problems enumerated.

Although the items or problems are listed in a variety of ways, the author points out that in a number of cases several problems seemed to be associated with one another, and it appeared advisable to measure this association statistically. For this purpose, Yule's coefficient of association was chosen. An "analysis of all the possible pairs of the fourteen problems of most frequent occurrence showed for boys a tendency toward complete association in the case of eight pairs of problems, and a tendency toward complete dissociation in the case of seven pairs. For girls, these coefficient showed a tendency toward complete association in the case of six pairs, and a tendency toward complete dissociation in the case of sixteen pairs." For the total number of cases, these coefficients showed "independence

in the case of one pair of problems; a tendency toward complete association in the case of five pairs; and a tendency toward complete dissociation in the case of six pairs."

Workers in the preschool field who continue to want case studies will be somewhat disappointed in Doctor Tilson's study. Perhaps the investigation does lack in so-called "human interest material," but to the reviewer this is one of its strongest attractions. For those interested in a purely objective and scientific enumeration of facts, the book will be welcomed. It is a most complete record, ably classified, well organized, and usable.

RUTH STREITZ

University of Cincinnati

CLEVELAND, ELIZABETH. *If Parents Only Knew.* New York: W. W. Norton & Company, Inc., 1929. 152 pp.

This posthumous book is addressed to parents to meet their frequent criticism of the public schools; to show that the very things which some of them are advocating are already being put into practice, and how the home can further the progressive program of the school. "The school must inform the home of its programs and purposes and explain what the function of the home should be in carrying out these programs and purposes."

The book attempts to assemble and classify such materials, growing out of the author's experiences as supervisor of the Council of the Board of Education with the Parent-Teacher Associations of Detroit. She centers her discussion around the "seven cardinal principles"—health, command of tools of fundamental processes, worthy home membership, vocation, recreation, citizenship, and character. A chapter is devoted to each "principle," and at the end of each chapter is "The Coöperative Parents' Catechism" and "Suggested Parent-Teacher Association Activities."

The author attempts to answer two questions:

What is the school trying to do for the child? and, *How can the home help?*

The book closes with an appreciation of the author by Dr. Helen T. Woolley. To read that chapter is to understand why the author draws all her samples of ideal public educational objectives and practices, and efforts at home school relationships from Detroit. She seems to think that the platoon system is the best means of furthering health, character, personality and citizenship.

The school undertakes to supply health information, cultivate good health habits and ideals of physical fitness, and asks the home to coöperate by securing definite information about what the school does, and to provide suitable conditions in the home for the child's best health and physical development. Parents are urged to familiarize themselves with the newer, happier, more effective teaching methods, and to help the child to further apply at home the skills and knowledge he acquires at school.

"The school can with undeniable truth assert that everything in the course of study is training the child to be a more effective home maker," not only in furnishing him knowledge, but in specific training in home-making, for girls particularly, in sewing, cooking, budgeting, practical nursing and child care; and to make the home a joyous center. But the author, without dwelling upon any of the values of family loyalties and the family as a socializing factor, warns the parent against the family ties which hinder independence of the child.

The "family group is a formidable force to oppose."

If parents only knew what the school is doing to familiarize the child with the various vocations, to find his place in life, and to fit him for that place, they, according to the author, would be much more optimistic about public education. The home is urged to cultivate in girls "an attitude which regards vocation not as livelihood, but as self-expression and fulfillment."

"The school recognizes the importance of teaching through play" and of developing appreciation of best literature, drama, music and art. The home may coöperate by encouraging play, by providing play materials and play opportunities, and by joining in the play.

The school attempts through all its activities, particularly through the social science curricula, to develop in the child "a sense of what citizenship in a democracy demands of him." Parents can help by promoting at home a democratic spirit, by interest in the issues of the day, and by faithful performance of their civic duties.

Through its curricular and extra-curricular program the school tries to build character. The home can help by reducing family annoyances to the child, by furthering a joyous home atmosphere, and by good example in the conduct of adults.

Undoubtedly the author has done a better job telling what the school is driving at than in advising parents how they can coöperate. Some parents may feel that the author, like nearly all other pedagogues, pats the teacher on the back with one hand and reaches down with the other to lift up the "lowly parent."

Nevertheless parents who can rise above their personal pride and can think objectively will welcome this book. Every parent ought to read it; every teacher, too.

GARRY CLEVELAND MYERS
Western Reserve University

RESEARCH ABSTRACTS and BIBLIOGRAPHIES

Address all communications relative to research abstracts and bibliographies to Editor A. S. Barr, University of Wisconsin, Madison, Wisconsin.

CAIRNS, LAURA. "A Scientific Basis for Health Instruction in Public Schools," Berkeley, California: *University of California Press,* 1929.

The materials which should be included in health instruction have been determined by the author from an analysis of the leading causes of morality and morbidity. Chapters one to four state the chief causes of death, sickness, and disabilities, according to authoritative books on this subject. The author presents a list of items of health instruction information which is necessary to overcome these conditions. These facts were then brought together in a checking sheet which was used in a survey at 21 high schools, 25 junior high schools, and 39 sixth grades in San Francisco, Oakland, Berkeley, and Richmond, California. On the basis of these data the author evaluates the health instruction program in these cities and offers recommendations for the improvement of health instruction.

"*Die erziehungswissenschaftliche Forschung. Paedagogische Gesamtbibliographie,*" (Educational Research. Complete Pedagogical Bibliography), Issued by authority of the Academy of Sciences of General Utility at Erfurt, in connection with the German Archiv of Juvenile Welfare, the German Council for Education and Instruction, the Library of the Prussian Ministry for Commerce and Trade, and the Central Institute for Education and Instruction. Edited by Professor Dr. Arthur Hoffman (Erfurt). Published by Kurt Stenger, Erfurt, Germany, 1929.

The Fifth Bibliographical Booklet of the above institution contains: (1) German educational books published in 1928, compiled by Werner Diederich (Greifswald). (2) German educational treatises and articles of 1928. A complete bibliography of the educational periodical literature written in the German language. Compiled by Else Beilig (Berlin) and Werner Diederich (Greifswald).

The Sixth Bibliographical Booklet contains: (1) a critical research report about the literature of didactics and methods of instruction in history for the last five years, by Herbert Freudenthal (Kiel); (2) German university educational publications for 1928 with supplements for 1925 to 1927, compiled by Kurt Gassen (Greifswald); (3) the science of education and teaching in the universities, technical Hochschulen, and pedagogical institutes of the German language territory, for the winter half-year, 1928-1929, compiled by Else Beilig (Berlin); and (4) study in the pedagogical academies of Prussia, winter-half year, 1928-1929, compiled on the basis of official reports.

"*Educational Accomplishment:* As Indicated by Tests and Measurements," Prepared by Bureau of Administrative

The "family group is a formidable force to oppose."

If parents only knew what the school is doing to familiarize the child with the various vocations, to find his place in life, and to fit him for that place, they, according to the author, would be much more optimistic about public education. The home is urged to cultivate in girls "an attitude which regards vocation not as livelihood, but as self-expression and fulfillment."

"The school recognizes the importance of teaching through play" and of developing appreciation of best literature, drama, music and art. The home may coöperate by encouraging play, by providing play materials and play opportunities, and by joining in the play.

The school attempts through all its activities, particularly through the social science curricula, to develop in the child "a sense of what citizenship in a democracy demands of him." Parents can help by promoting at home a democratic spirit, by interest in the issues of the day, and by faithful performance of their civic duties.

Through its curricular and extra-curricular program the school tries to build character. The home can help by reducing family annoyances to the child, by furthering a joyous home atmosphere, and by good example in the conduct of adults.

Undoubtedly the author has done a better job telling what the school is driving at than in advising parents how they can coöperate. Some parents may feel that the author, like nearly all other pedagogues, pats the teacher on the back with one hand and reaches down with the other to lift up the "lowly parent."

Nevertheless parents who can rise above their personal pride and can think objectively will welcome this book. Every parent ought to read it; every teacher, too.

GARRY CLEVELAND MYERS
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RESEARCH ABSTRACTS and BIBLIOGRAPHIES

Address all communications relative to research abstracts and bibliographies to Editor A. S. Barr, University of Wisconsin, Madison, Wisconsin.

CAIRNS, LAURA. "A Scientific Basis for Health Instruction in Public Schools," Berkeley, California: *University of California Press*, 1929.

The materials which should be included in health instruction have been determined by the author from an analysis of the leading causes of morality and morbidity. Chapters one to four state the chief causes of death, sickness, and disabilities, according to authoritative books on this subject. The author presents a list of items of health instruction information which is necessary to overcome these conditions. These facts were then brought together in a checking sheet which was used in a survey at 21 high schools, 25 junior high schools, and 39 sixth grades in San Francisco, Oakland, Berkeley, and Richmond, California. On the basis of these data the author evaluates the health instruction program in these cities and offers recommendations for the improvement of health instruction.

"*Die erziehungswissenschaftliche Forschung. Paedagogische Gesamtbibliographie,*" (Educational Research. Complete Pedagogical Bibliography), Issued by authority of the Academy of Sciences of General Utility at Erfurt, in connection with the German Archiv of Juvenile Welfare, the German Council for Education and Instruction, the Library of the Prussian Ministry for Commerce and Trade, and the Central Institute for Education and Instruction. Edited by Professor Dr. Arthur Hoffman (Erfurt). Published by Kurt Stenger, Erfurt, Germany, 1929.

The Fifth Bibliographical Booklet of the above institution contains: (1) German educational books published in 1928, compiled by Werner Diederich (Greifswald). (2) German educational treatises and articles of 1928. A complete bibliography of the educational periodical literature written in the German language. Compiled by Else Beilig (Berlin) and Werner Diederich (Greifswald).

The Sixth Bibliographical Booklet contains: (1) a critical research report about the literature of didactics and methods of instruction in history for the last five years, by Herbert Freudenthal (Kiel); (2) German university educational publications for 1928 with supplements for 1925 to 1927, compiled by Kurt Gassen (Greifswald); (3) the science of education and teaching in the universities, technical Hochschulen, and pedagogical institutes of the German language territory, for the winter half-year, 1928-1929, compiled by Else Beilig (Berlin); and (4) study in the pedagogical academies of Prussia, winter-half year, 1928-1929, compiled on the basis of official reports.

"*Educational Accomplishment:* As Indicated by Tests and Measurements," Prepared by Bureau of Administrative

Research, Pasadena City Schools, (1929), 55 pp.

This bulletin presents a statistical and graphical survey of the instructional activities of the Pasadena Public Schools. A graphic rating scale for pupils' habits, attitudes, and traits is presented with data on its reliability and comparison with intelligence and scholastic records.

GORHAM, MAUDE I., AND TRACY, ORVAL. "An Extension Course in Diagnostic and Remedial Measures in Reading in Smith County, Kansas," Topeka, Kansas: Kansas State Printing Plant, (1929), 40 pp.

This bulletin presents objective evidence bearing upon the effectiveness of a remedial program in reading carried out in the extension department of the Kansas State Teachers College of Hays, Kansas.

"Organization of Administration and Supervision of the Oakland Public Schools," *Superintendent's Bulletin*, X, (November 7, 1929), 35 pp.

This bulletin presents an organization chart for the Oakland Public Schools with a discussion of the duties, functions, and relations of the several departments concerned.

NELSON, MARTIN J. "The Differences in the Achievement of Elementary School Pupils Before and After the Summer Vacation," *Bureau of Educational Research Bulletin, University of Wisconsin* (June, 1929), 48 pp.

A study of losses and gains in pupil achievement during summer vacation. Tests were given in May and September of 1926 and 1927 to about 75 pupils in each of Grades 3A, 5A, and 7B in 5 schools of East Waterloo, Iowa. The study indicates that all grades gain in intelligence and in handwriting from May to September, and that, with the exception of 7B reading, there was a loss in all other subjects. It required from 2 to 15 weeks for pupils to regain in the fall the information lost during vacation.

WALLIN, J. E. W. "A Brief Survey of Special Education in the Public Schools of Baltimore," Baltimore, Maryland: *Department of Education*, (August, 1929), 57 pp.

The author recommends definite standards of admission, scientifically established for the assignment of pupils to special classes. It is further recommended that no child should be assigned to special schools for the mentally deficient without a thorough individual examination—physical, psychological, developmental, and environmental. The author believes that the proper handling of mentally handicapped children requires a system of special classes or schools for those most seriously handicapped and a system of ungraded classes for the borderline and retardative cases.

WOODS, ELIZABETH L. "Third Yearbook of the Psychology and Educational Research Division," Los Angeles: *Los Angeles Public Schools*, (1929), 239 pp.

This bulletin contains a discussion of the organization of the division of psychology and educational research and a report of studies made in elementary and high schools. There are sections for special classes, curriculum research, and other research studies.

ZEMAN, PROF. DR. HANS (Vienna). "The Science of Eidetic and its Practical Significance," (*Die Lehre von der Eidetik und ihre praktische Bedeutung*). *Die Quelle*, 79th year, (Jan-

uary, 1929) 6-17; (February, 1929) 171-176. Published by *Deutscher Verlag für Jugend und Volk*, Vienna, Austria.

This article offers a survey of the results of eidetic research, in Germany and Austria, and contains a report of an eidetic investigation made in Vienna.

Eidetic research is a psychological new land. Dr. E. R. Jaensch (Marburg) describes the phenomenon as follows: "The eideticer (Eir) cannot only produce a picture or a concrete object as an image but as a concrete, existing image (anschaulich), i.e., he can, after a previously presented picture is taken away, not only imagine it, but, in the verbal sense, re-see it. Eidetic dispositions (Ei) occur in adults and are normal in children, especially during the stage of puberty.

The author experimented for 10 months with 200 subjects, pupil and adult volunteers. The result was that 176 subjects, or 88 percent, showed eidetical disposition. Other German investigators found 85 to 90 percent eidetic disposition.

Jaensch and his school divide all eideticer into two varieties, named T and B respectively. The T-constitution is "marked by galvanic and mechanical hyper-excitability of the peripheral, especially of the motor, nerves." The B-constitution tends toward the Basedows syndrome. Jaensch is inclined to relate the eidetic phenomenon to some kind of inner secretion.

The significance of eidetic disposition for schools and educators lies in its close connection with the development of youth. There are according to the above T- and B-constitutions, two groups or types of pupils, the *Tetanoid* and the *Basedowoid*. For both types distinct forms of behavior are given by Kroh and other investigators. The pupil's activity is strongly influenced by his eidetic disposition. Obviously, this is to be seen in such school subjects as drawing, where the eidetic disposition is of great help. Individualized instruction should consider this phenomenon. Problem cases, also, will often find their solution in investigations of the pupil's eidetic disposition. Remedial work may further or prevent the use of eidetical images. The problem of eidetics shows, from a general viewpoint, the importance of *sense-impression* (Anschaulichkeit) for all our school work.

EXPERIMENTAL STUDIES REPORTED IN CURRENT ISSUES OF OTHER MAGAZINES

EDUCATIONAL ADMINISTRATION AND SUPERVISION

ANDERSON, EARL W. "A Study in Supply and Demand," *Educational Research Bulletin*, Ohio State University, VIII, (December 4, 1929), 399-403.

A factual study of the supply and demand of teachers in the state of Ohio, giving data relative to salaries, the demand for teachers by subjects, combinations of subjects, etc.

MELBY, ERNEST O. "The Organization of High-School Supervision in Certain Cities," *The School Review*, XXXVII, (December, 1929), 736-746.

This article describes practices in the organization of high-school supervision in the cities between 10,000 and 20,000 in population.

MELBY, ERNEST O. "The Superintendent and the Organization of Supervision," *Educational Administration and Supervision*, XV, (December, 1929), 641-654.

The author presents data on the organization of supervision in cities rang-

ing in size from ten to twenty thousand in population.

MONROE, WALTER S. "The Effect of Participation in Extra-Curriculum Activities on Scholarship in the High School," *The School Review*, XXXVII, (December, 1929), 747-752.

This article briefly reports two investigations—one, in the senior high school of Kenosha, Wisconsin; the other, in three township high schools in Illinois—of the effect on scholarship of participation in extra-curricular activities in the high school. The author concludes that participation in extra-curricular activities are beneficial rather than detrimental to school studies.

RHODES, EARL N. "The Extent to Which Graduates from Differentiated Curricula of Teachers Colleges Teach in Their Specialized Fields," *Educational Administration and Supervision*, XV, (December, 1929), 667-677.

The author presents data showing that there is an oversupply of teachers and that many are teaching out of their specialized fields, and raises questions relative to best methods of meeting the situation described.

RICH, FRANK M. "Analysis of Teachers' Work," Chapter V, *The Sixth Yearbook*, 178-196.

A check list analyzing the teachers' work in reading, literature, geography, history, writing, spelling, oral and written composition, grammar, arithmetic, science, manual art, sewing, domestic science, music, and physical training. There are also items dealing with classroom management, control, and professional services.

SMITH, W. R. AND DITMARS, THOMAS. "Social Composition of the Kansas City, Missouri, High Schools," University of Kansas *Bulletin of Education*, II, (December, 1929), 15-20.

A questionnaire study of the social composition of the high schools of Kansas City, Missouri. Data are given relative to the percentage of students from each occupational group, such as choice of occupation, intentions of going to college, and median scores for intelligence and achievement.

THORNGATE, VESTA M. "The Departmental Headship in Mathematics in Senior High Schools," *Educational Research Record*, University of Nebraska, II, (October, 1929), 9-14.

The data for this study were obtained from 109 questionnaires returned by heads of mathematics departments located in 79 cities of 3,000 and above in population. Data are presented relative to the number of pupils in the department, the number of teachers, salaries, professional preparation of teachers, and supervisory and administrative duties. The author emphasizes in the conclusions the importance of supervision and the training of heads of departments for this responsibility.

PSYCHOLOGY OF LEARNING

BASSETT, SARAH JANET. "Factors Influencing Retention of History in the Sixth, Seventh and Eighth Grades," *The Journal of Educational Psychology*, XX, (December, 1929), 683-690.

The author points out the relationship between mental age, chronological age, height and weight, subject preference, reading comprehension, and performance in history.

DEARBORN, WALTER F. "Teaching Reading to Non-Readers," *The Elementary School Journal*, XXX, (December, 1929), 266-269.

The author points out that difficulties in reading are frequently traceable to two similar conditions: (1) the reversal in the forms of certain letters, for example, "God" and "dog"; (2) alterations in the correct sequence of letters, for example, "framing" and "farming."

LEWERENZ, ALFRED S. "Objective Measurement of Diverse Types of Reading Materials," *Educational Research Bulletin*, Los Angeles City Schools, IX, (October, 1929), 8-11.

The author indicates a procedure for determining the vocabulary difficulty of reading materials, and presents results for analysis of vocabulary grade placements for seven representative series of readers.

SANDERSON, SIDNEY. "Intention in Motor Learning," *Journal of Experimental Psychology*, XII, (December, 1929), 463-489.

The author reviews the literature dealing with the importance of mind set or attitude in learning and presents experimental evidence in the field of motor learning supporting this view.

EXPERIMENTAL STUDIES OF TEACHING

CRIDER, BLAKE. "The Corrective Value of Repeated Translations," *The School Review*, XXXVII, (December, 1929), 771-779.

The subjects for the experiment were 97 students composing three classes of first-year Spanish in Albion College, Albion, Michigan. The author concludes from the data presented that intensive translation is not advisable.

LEWERENZ, ALFRED S. "Some Results of a Visual Education Lesson in Junior High-School Social Studies Taught with the Aid of Flat Pictures," *Educational Research Bulletin*, Los Angeles City Schools, IX, (November, 1929), 4-16.

An experimental study of the value of flat pictures in teaching. Eight 7 x 9 photographs taken from scenes in the Yale University moving picture film, "Columbus," were bound in photographic albums for use. The author indicates certain cautions that ought to be taken in order to get maximum value from the use of flat pictures in class work.

RUSSELL, F. O., AND LONG, IRMA B. "A Comparison of Two Methods of Instruction in Seventh-Grade Mathematics," University of Kansas *Bulletin of Education*, II, (December, 1929), 21-24.

An experimental study of the relative superiority of individual instruction. Twenty-one pairs, or 42 students, are involved in the study. The mean score of the experimental group exceeded the mean score of the control group in all tests.

CURRICULUM RESEARCH

KIEBLER, E. W., AND CURTIS, FRANCIS D. "A Study of the Content of the Laboratory Course in High-School Physics," *School Science and Mathematics*, XXIX, (December, 1929), 980-985.

An analysis of the laboratory exercises found in eight high-school manuals in physics.

MUTHERSBAUGH, G. C. "Objectives of a Proposed Course of Study in Physics

for Senior High Schools," *School Science and Mathematics*, XXIX, (December, 1929), 943-954.

The author presents a list of specific objectives for 43 units of a proposed course in physics based upon an analysis of four textbooks, four courses of study, and two treatises on physics.

MEASUREMENTS

DAVIES, G. R. "The Analysis of Frequency Distributions," *Journal of the American Statistical Association*, XXIV, (December, 1929), 349-366.

A helpful article pointing out sources of error in the elementary statistical procedures ordinarily used in the analysis of frequency distributions.

THURSTONE, L. L., AND JENKINS, RICHARD L. "Birth Order and Intelligence," *The Journal of Educational Psychology*, XX, (December, 1929), 641-651.

The present investigation seems to justify the conclusion that the mean intelligence quotient increases with birth order. The later born children seem to be brighter on the average than earlier born children.

NEW TESTS

BROWN, EDWIN J. "A Self-Rating Scale for Supervisors, Supervisory-Principals, and Helping-Teachers," Milwaukee, Wisconsin: The Bruce Publishing Company, 1929.

The scale is composed of 9 major divisions and 50 subdivisions. The items are based upon a survey of textbooks in the field of supervision.

LEAMER, EMERY W. "Leamer Diagnostic Practice Sentences in Handwriting," Bloomington, Illinois: Public School Publishing Company, 1929.

This test is available in two arrangements: (1) The original arrangement in which the 15 cards (5 series) are placed in an envelope (recommended when the pupils buy the material), and (2) a new arrangement in which the cards are supplied in cabinets (recommended when the schools pay for the material).

SONES W. W. D., AND HARRY, DAVID P., JR. "Sones-Harry High-School Achievement Test," Chicago: World Book Company, 1929.

The test covers the four subject fields in secondary education, namely, language and literature, mathematics, natural science, and the social studies.

VAN ALSTYNE, DOROTHY. "Van Alstyne Picture Vocabulary Test for Pre-School Children," Bloomington, Illinois: Public School Publishing Company, 1929.

There are 45 cards with 4 pictures on each card. The test covers 31 nouns and 14 verbs. The special features claimed for the test are: (1) no oral response is necessary; (2) the test is absolutely objective in regard to scoring; (3) there can be no ambiguities to the child in the questions asked; (4) the test is short—approximately fifteen minutes of testing time is required to give the test; and (5) the test proves interesting to the child and provides an excellent means for establishing rapport for further testing.

MISCELLANEOUS

NEWLON, JESSE H. "John Dewey's Influence in the Schools," *Teachers College Record*, Columbia University, XXXI, (December, 1929), 224-238.

This and other articles in this issue of the *Teachers College Record* contain evaluations of John Dewey's contribution to educational movements in this country.

BAIN, READ. "The Validity of Life Histories and Diaries," *The Journal of Educational Sociology*, III, (November, 1929), 150-164.

The author concludes that life documents have value in social casework, but that good casework is much more objective and obtains verified facts which are never or seldom contained in life documents.

PINE, ELSIE HOWARD. "The High-School Library," *Teaching*, (September, 1929), 61 pp.

This library science number of the journal of the Kansas State Teachers College, Emporia, Kansas, carries the results of a survey of high-school libraries in the state of Kansas, with recommendations concerning standards of organization and administration, the selection and care of books, library instruction, etc. The report follows that of C. C. Certain on library standards. The bulletin also contains a list of books, periodicals for high-school libraries, and a collection of pictures.

SHANNON, J. R. "The Post-School Careers of High-School Leaders and High-School Scholars," *The School Review*, XXXVII, (November, 1929), 656-665.

A study of the post-school careers of three groups of graduates from one of the city high schools in Terre Haute, one composed of high-school leaders, one of pupils on the honor roll, and a third composed of a random sampling of pupils, most of whom were neither leaders nor scholars. There were 25 students in the first group, 32 in the second, and 38 in the third. The author concludes that graduates from the leaders group have made a better showing in most respects than scholars or members selected from the random group.

WAPLES, DOUGLAS. "Teachers' Reading of Non-Fiction," *Educational Research Bulletin*, Ohio State University, VIII, (November 20, 1929), 377-382.

A study of the reading interests of teachers in the field of non-fiction. A classified list of 575 questions, each to be rated on a three-point scale, was used in studying the reading interests of senior high-school pupils, teachers, and other adult groups.

RESEARCH NEWS and COMMUNICATIONS

Address all research news and communications to Editor V. T. Thayer, Ethical Culture Schools, 33 Central Park West, New York City.

The annual meeting of the National Association of Commercial Teacher Training Institutions will be held on Friday, February 28, 1930, at New York University, Washington Square East, New York City, in conjunction with a research conference on commercial education to be held under the auspices of the New York University Commercial Teachers Club, and on the occasion of the dedication of the new School of Education building at New York University.

Activities of the Social Studies Investigation

The Investigation of History and Other Social Studies in the Schools, sponsored by the American Historical Association, is vested in a Commission on Direction. The members of the Commission on Direction are:

Frank W. Ballou, Superintendent of Schools, Washington, D. C.
Charles A. Beard, New Milford, Conn.
Isaiah Bowman, American Geographical Society
Ada Comstock, Radcliffe College
George S. Counts, Teachers College, Columbia University
Guy Stanton Ford, University of Minnesota
Evarts B. Greene, Columbia University
Ernest Horn, State University of Iowa.
Henry Johnson, Teachers College, Columbia University
W. E. Lingelbach, University of Pennsylvania
Leon C. Marshall, Johns Hopkins University
Charles E. Merriam, University of Chicago
Jesse H. Newlon, Director, Lincoln School, New York City
Jesse F. Steiner, Tulane University
A. C. Krey, *Chairman*, University of Minnesota

The Executive Committee for the present year includes: A. C. Krey, who is also serving as Director of the Investigation, Charles E. Merriam, and Jesse H. Newlon.

Funds were made available through a grant from the Carnegie Foundation in March, 1929, and active work was started at once.

For the current academic year the Investigation has obtained the assistance of Professor Truman L. Kelley, Stanford University, who has consented to serve as technical adviser on tests and measurements. W. G. Kimmel, formerly Supervisor of Social Studies, New York State Education Department, will serve as executive secretary of the staff.

Further announcements will be made in later issues of this publication. In the meantime, communications should be addressed either to 610 Fayerweather Hall, Columbia University, New York City, or to Room 316, Library, University of Minnesota, Minneapolis.

Predicting Success in Algebra

Many schools are grouping their students in the various subjects according to

ability. An endeavor is made to group the students in a particular subject according to their probable success in that subject. One of the problems in selecting students for the different ability groups is to determine the best basis for predicting a student's probable success in a subject. The basis for such prediction has usually been either the intelligence quotient, the score on a standard achievement test, or the score on a standard subject test.

The study here reported is an attempt to determine the relative value of the Group Intelligence Quotient, score on the Revision of the Stanford Achievement Test, score on the Arithmetic Computation section of the Revision of the Stanford Achievement Test, score on the Arithmetic Reasoning section of the Revision of the Stanford Achievement Test, score on the Terman Group Test, score on the number series section of the Terman Group Test, and score on the arithmetic section of the Terman Group Test in predicting a student's success in algebra.

The data for this study were obtained at the Palo Alto Union High School on students who were completing their first semester in algebra. The School Counselor gave the Terman Group Test of Mental Ability to all new students. The Group Intelligence Quotient for each student was derived from this test. Some of the students had been given the Revision of the Stanford Achievement Test just before they entered the high school. The results of that test were available and are incorporated in this study.

Success in algebra was measured by the Douglass Stanford Diagnostic Algebra Tests, Series A, Form I. Since the students were just completing their first semester's work in elementary algebra, they had covered the fundamentals of the subject; namely, addition, subtraction, multiplication, division, and simple equations. It was necessary to choose a test which covered these fundamentals of algebra. The Douglass Test filled this requirement.

The four first-semester algebra sections were given the Douglass Test by the same person. In rating the students on such a test the question of proper motivation always presents itself. It seems reasonable to assume that the majority of these students did their best, since the tests were given during the final week of the semester and they were told that the scores on the algebra tests would be taken into consideration when the semester grades were assigned. The factor of group competition entered when the students were told that a comparison would be made between the average scores of each group. The scores on the test were well scattered. No student made a perfect score.

There were 32 students in Group I, 24 in Group II, 28 in Group III, and 32 in Group IV. Groups II and III were taught by the same teacher, while Groups I and IV were taught by different teachers. Scores on the Terman Group Test were available for all of these students. The students in each group were ranked according to their scores on the algebra tests. The product-moment method was used in computing the coefficient of correlation for each group between the score in algebra and the Group Intelligence Quotients, scores on the number series section of the Terman Group Test, scores on the arithmetic section of the Terman Group Test, and scores on the Terman Group Test. The results are given in Table I.

TABLE I

	G.I.Q.	T.G.T.
Group I	.54±.08	.27±.11
Group II	.47±.11	.32±.12
Group III	.34±.11	.27±.12
Group IV	.42±.10	.31±.11
Av.	.42±.10	.31±.11
	T.G.N.S.	T.G.A.
Group I	.53±.08	.44±.09
Group II	.19±.13	.29±.12
Group III	.25±.12	.26±.12
Group IV	.32±.11	.31±.11
Av.	.32±.11	.31±.11

The correlations are not exceedingly high. Evidently there are factors other than intelligence and ability in arithmetic affecting a student's success in algebra. The coefficients of correlation of the different items vary considerably among the four groups. Those for the Group Intelligence Quotient, however, are most consistent and give a higher average. Also, with but one exception, the coefficients of correlation between the Group Intelligence Quotients and success in algebra, as measured by the Douglass Standard Algebra Tests, for each group exceed the coefficients of correlation between success in algebra and the other criteria. The one exception is found in Group IV. Here the coefficient of correlation between success in algebra and scores on the Terman Group Test has the advantage.

Scores on the Revision of the Stanford Achievement Test were available on 48 of the students among the four groups. These 48 students composed the fifth group in the study. The coefficient of correlation was computed between the scores in algebra and Group Intelligence Quotients, scores on the Revision of the Stanford Achievement Test, scores on the Arithmetic computation section of the Revision of the Stanford Achievement Test, scores on the arithmetic reasoning section of the Revision of the Stanford Achievement Test, scores on the Terman Group Test, scores on the number series section of the Terman Group Test, and scores on the arithmetic section of the Terman Group Test. These results are given in Table II.

TABLE II

	G.I.Q.	S.A.	A.C.S.A.
Group V	.57±.06	.46±.08	.36±.08
A.R.S.A.	T.G.T.	T.G.N.S.	T.G.A.
.39±.08	.43±.08	.38±.08	.49±.07

Here again the Group Intelligence Quotient gives the highest coefficient of correlation with success in algebra as measured by the Douglass Algebra Tests. This advantage of the Group Intelligence Quotient might possibly be attributed to the fact that in computing the G.I.Q. the chronological age of the individual is taken into consideration.

The following conclusions may be drawn from this study: (1) The Group Intelligence Quotient as determined by the Terman Group Test of Mental Ability is a better basis for grouping students in algebra according to probable success than any of the other criteria used in this study. (2) There are too many unmeasurable factors to permit the accurate prediction of success in algebra. Among these unmeasurable factors may be mentioned industry and interest on the part of the student, and also attitude of the student toward the teacher.

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THE EFFECT OF COURSES IN "THE TEACHING OF ARITHMETIC" UPON ARITHMETIC SKILLS

The arithmetic disabilities of normal school students,—prospective teachers in the elementary schools,—furnish the text for many discussions at gatherings of normal school instructors. In a paper read at the annual meeting of the American Association of Teachers Colleges, at Boston, in February, 1928, Dr. E. H. Taylor of the Eastern Illinois State Teachers College, said: ". . . Most high-school graduates have neither the skill in com-

putation, mastery of facts, nor ability to solve problems to fit them to teach arithmetic. . . . A large number of teachers may receive a two-year diploma without having any arithmetic beyond that taken in the eighth grade. A still larger number may, and no doubt do, graduate with no arithmetic except a short course in methods of teaching.'' Dr. Taylor's conclusion is that arithmetic should be taught in teachers colleges, and he insists upon its values for general culture, for its use in practical affairs, and for the training it gives in dealing with quantitative relations.

A one-semester course in the teaching of Numbers, meeting two hours a week, is required in the Pennsylvania Teachers Colleges for all students preparing to teach in the primary grades, and a one-semester course in the Teaching of Arithmetic, meeting three hours a week, is required of students preparing to teach in grades four, five, or six. Some of the teachers colleges provide non-credit courses in arithmetic, to be taken by such of their students who fail to give evidence of satisfactory proficiency in the subject. These courses are supplementary to the regular required courses.

A question that may properly be raised in considering the establishment of such a supplementary course is the following: ''What is the effect of the regular course in the Teaching of Arithmetic upon the student's abilities in arithmetic? That is to say, does his studying of the processes, by which arithmetic is taught to children, increase or decrease his own command of arithmetic operations? Obviously, if the course in the Teaching of Arithmetic were found to increase markedly the arithmetic skills of the students enrolled in it, there might be no necessity for an additional subject-matter course in arithmetic designed to remedy deficiencies of such students. The present study was made in the hope that it would provide an answer to the above question.

At the beginning of the second semester of the school year, 1928-29, 300 freshmen students were required to take the Monroe Standardized Survey Scale in arithmetic, Form I of Scale II. At the close of the semester, these students took the same test using Form III of Scale II. It was hoped that comparison of the results of the two tests would furnish significant information bearing upon the question of the need of providing remedial classes in arithmetic subject-matter during the next school year.

The students who took these tests fall into three groups: those who took the course in the Teaching of Numbers during the semester; those who took the course in the Teaching of Arithmetic; and those who, for one reason or another, took no course in mathematics during the semester. It is clear that the two-hour course in the Teaching of Numbers provides fewer opportunities, and makes fewer demands in the field of arithmetic operations, than does the three-hour course in the Teaching of Arithmetic. The effect of these differences upon the performance of the two groups was looked for with interest. Likewise, it was anticipated that there would be a difference between the performances of the first two groups taken together and the third group which did no work in arithmetic during the semester.

The results of the two tests may be expressed by stating that some of the students from each group did better on the second test than on the first, while some did poorer work the second time. Some students were below the median for Grade VIII on the first test and above the median on the second test. The results of

the two tests are compiled in the following table:

The columns headed 'Amount' are expressed in terms of points on the scores made in the tests. Thus, the first line of the table is to be read: thirty-four percent of the first group had scores on the second test that were an average of 12 points lower than their first scores; sixty-six percent of the first group had scores on the second test that were higher than their first scores by an average of 15 points; thirty-seven percent of the group were above Grade VIII median in both tests; twenty-two percent of the group were below Grade VIII median on the first test, but above on the second; eight percent were above Grade VIII in the first test, and below in the second; thirty-four percent of the group were below Grade VIII median in both tests.

TABLE I

Subject Studied During Semester	No. of Cases	Percent of Group that Lost	Am't	Percent of Group that Gained	Am't	Percent Above Median Both Times	Percent Above Median Than Below	Percent Below Median Than Above	Percent Below Median Both Times
Teaching of Numbers	65	34	12	66	15	37	8	22	34
Teaching of Arithmetic	146	36	10	64	18	58	5	14	23
No Course in Arithmetic	34	60	10	40	23	53	12	12	24

The significant facts brought out by the data may be stated as follows:

(1) There is a heavy load of arithmetic disability, since 26 percent of the entire number of cases involved in the study were below Grade VIII standard in both tests, and 27 percent of those who took courses in Teaching of Numbers and Teaching of Arithmetic were below Grade VIII standard in the second test.

(2) The students who took the course in the Teaching of Numbers are definitely less able in arithmetic, since only 37 percent of them were above Grade VIII median in both tests, as contrasted with 58 percent of the Teaching of Arithmetic group who were above Grade VIII median in both tests; and 34 percent were below Grade VIII median in both tests, as contrasted with 23 percent of the Teaching of Arithmetic group, who were below Grade VIII median on both tests.

(3) The students who took no course in the Teaching of Numbers or Arithmetic, are about on the same level of ability as the students who took the course in Teaching of Arithmetic, as shown by comparing the percents of the two groups that were above Grade VIII median on both tests. The group taking the course in the Teaching of Arithmetic during the semester, however, showed a much higher percentage of gain in arithmetic skill at the end of the semester than did those who took no course in teaching.

(4) There is no significant difference in the amount of loss or gain due to the courses in Teaching of Numbers and Teaching of Arithmetic.

(5) There appears to be some positive effect of the study of courses in Teaching of Arithmetic upon skills in arithmetic, since in the group that did not take any such course 60 percent did poorer work on the second test than on the first test, as contrasted with 35 percent in the groups that did take such courses.

(6) There undoubtedly is a need for remedial courses in arithmetic, inasmuch as so large a percentage of the whole group is below Grade VIII median even

after taking the course in Teaching of Numbers or Teaching of Arithmetic.

CONCLUSION

The courses in the Teaching of Numbers and the Teaching of Arithmetic given in the Teachers Colleges have a positive effect upon the arithmetic skills of the students enrolled in them. This effect, however, is insufficient to overcome the initial arithmetic disabilities in many students.

Remedial work for students below standard in arithmetic is justified and is necessary.

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A FACTOR IN LANGUAGE ABILITY

It would not seem to be an unreasonable assumption that auditory imagery is an important factor in language ability. Thus, the facility with which words come to us, quite apart from any critical or discriminating use of them, would seem, offhand, to be connected in a natural fashion with our ability to reproduce them internally. This assumption is not the same as the one-time popular supposition that we remember everything in terms of imagery, which has largely fallen into disrepute, but due to feeling that there may be an auditory factor in language ability as such auditory imagery should facilitate our learning to speak a foreign language. The great differences in oral and written language work, and the differences shown by individuals in "picking up" a foreign tongue, may receive some light from the study of the contribution of auditory imagery. In fact, different methods of approach to the study of a foreign language may be advisable because of such differences in individual students. The study reported herein is given to a study of this possibility.

Thirty-seven subjects were given the following tests and the correlations worked out between many pairs and combinations.

(a) The Trabue Language Completion Test was taken as the criterion of language ability. It seemed to lack something considering the nature of the problem investigated, but it was apparently the most satisfactory test available.

(b) The Otis Self-Administering Test of Mental Ability was also given to the subjects, who were all of college grade, in order to partial out, in the correlations, the intelligence factor in the Trabue test. It was known that the language completion test had a high correlation with intelligence, and it was not this aspect of language ability that we wished to measure.

(c) A test on the ability to recall ideas. The old Athenian oath was read to the subjects five times, and they were then asked to reproduce it in writing. Their score was derived from the number of words correctly reproduced.

(d) A test in the ability to recall unrelated words. Series of words, wholly unrelated, were read to the subjects, and their scores were based on the number correctly reproduced in writing.

(e) The auditory-digit span. The score was the number of digits in the longest series which they could reproduce correctly.

(f) A test on the ability to write nonsense syllables, which were pronounced in series of varying length.

(g) A test of ability to reproduce rhymes for certain words, scored on the total number of rhymes produced within three minutes.

Each one of the tests was correlated with the Trabue test and with Otis Intelligence test. Following are the coefficients of correlation:

	Lang.	Digits	Words	Ideas	Nons. Syll.	Rhymes
Intelligence	.65	.03	.29	.73	.43	.62
Language Ability		.18	.34	.41	.35	.44
Language Ability (partial r's with the Int. Test Score held constant)		.26	.21	.01	.10	.06

The partial correlation coefficients seem to show that the only tests that have anything in common with language ability after the influence of intelligence is removed are those testing the auditory memory span for digits, the ability to recall unrelated words, and (possibly) the ability to take nonsense syllables from dictation. The ability to recall ideas is taken care of by the intelligence factor and shows no relationship with any residue in the language test. That the ability to reproduce rhymes should be in the same category seems rather difficult to explain at first, unless we remember that the person who produced the greatest number of rhymes might have been the one who had the best method or plan (intelligent) of finding them. Such a plan might have been one using all the consonants in order.

Another step was taken by adding together the scores on the Digit test, the Unrelated Word test, and the Nonsense Syllables test, (those tests that seemed to show some direct relation with language ability apart from the intellectual factor involved) and correlating this composite score with both the Otis and the Trabue tests. The correlation between this composite score and the Otis test was .39, and between the composite score and the Trabue test was .49. The partial "r," found between the composite score and the Trabue test, with the Otis score held constant, was found to be .31.

It seems very probable from this last correlation coefficient that the ability to reproduce spoken digits, unrelated words, and nonsense syllables, has a definite contribution to make to language ability, or better, that they have something in common with language ability quite apart from any relationship through general intelligence. Is this common factor one of facility to use auditory imagery? It seems reasonable to suppose that the ability to reproduce a series of digits, unrelated words, and nonsense syllables, which have been given orally, is largely a matter for the sense of hearing and its retained impressions to take care of. Language ability, then, also must owe a great deal to good auditory imagery, particularly that form of language ability or facility commonly known as "glibness."

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ARITHMETIC AND COLLEGE FRESHMEN

At a meeting of the American Association of Teachers Colleges held in Boston in February, 1928, Dr. E. E. Taylor, of Eastern State Teachers College, Charleston, Illinois, presented a paper showing that college freshmen have surprisingly little knowledge of, or skill in arithmetic. It was further suggested that since the ordinary course in methods of teaching arithmetic could provide very little drill on fundamentals, that there should be offered a college course in arithmetic for teachers of arithmetic. From six to ten years of arithmetic in pre-college work is not enough; we must still continue to teach or at least to give credit for arithmetic in college.

The author of this article was bold enough to be less pessimistic. Too much

reliance should not be placed upon tests given to college freshmen during the first week of their college life. The following data came from a study showing the ability in arithmetic at the beginning of the first semester of college work, and at the end of two months' work, as measured by the Monroe Survey Test. Table I shows a gain of 55.0 ± 2.6 points which is clearly significant. Furthermore, this gain is equal to 5.4 years progress. Notice also that nearly one-fourth of the students were below the arbitrary state standard of 78 in September, but none were below this in November. In September, 10 percent were even below the eighth-grade norm.

The gain column shows gains ranging from 9 to 95 points. While not all students did extra drill work, since many of them were above the standard set, still no one failed to improve his first score by a liberal increment during two months in school.

TABLE I

MONROE SURVEY TEST GIVEN TO COLLEGE FRESHMEN AT THE DATES INDICATED

Score	Sept. 24	Nov. 30	Gain
190-199		3	
180-189		1	
170-179		6	
160-169		7	
150-159		8	
140-149	1	7	
130-139	1	11	
120-129	3	12	
110-119	2	5	
100-109	6	6	
90- 99	11	3	2
80- 89	18	1	5
70- 79	12		4
60- 69	9		7
50- 59	4		19
40- 49	2		18
30- 39	1		8
20- 29			4
10- 19			2
0- 9			1
Total	70	70	70
Median	83.9	137.3	
Mean	84.9 ± 1.6	139.9 ± 2.1	
Sigma	20.7 ± 1.1	26.0 ± 1.4	
Gain		55.0 ± 2.6	
Years gain (10.2 per yr.)		5.4 years	
Percent below 100	81.4	5.7	
State Norm (78)	40.0	0	
8th grade (61)	10.0	0	

While one bird does not make a summer and the results from one school with only 70 students participating does not prove anything, nevertheless it does suggest some possible conclusions. Before drawing these conclusions something should be said about the activities during those two months. The students were shown the results of their examinations with a short talk something like this, "It is assumed by Miami University that no one can teach arithmetic unless he knows arithmetic. The test has displayed some great lacks of such knowledge. It is also assumed that no college student expects to get college credit for learning that 9 plus 7 are 16 or even that 2 divided by .04 equals 50 and not .05. As a consequence of the first assumption we set up an arbitrary standard of 78, the State norm on the Monroe test, as a minimum score for anyone who deserves to pass this course in the teaching of arithmetic and look with disfavor upon any score below 100. As a consequence of the second assumption we will set aside some room for certain hours of the day and provide practice materials for those who have 'forgotten' much of their arithmetic. There will also be available a faculty member from the department to assist in any needed explanations of difficulties. Do not feel that you are disgraced because you made a low score on this test. Not having had any arithmetic for a few years some of you have merely forgotten much of it. Some of you had poor teachers and never did know. Some of you made careless mistakes due to the first week of school. It is a waste of time, however, to hunt for an alibi; the thing

to do is to get busy. You would have little respect for us if we did not require you to know arithmetic before you teach it. At Thanksgiving time we will give you another test, and if necessary another as a Christmas present. Part of your final examination will also be an arithmetic test. Now we want you who are below what you ought to be in arithmetic ability to use good learning methods and bring yourselves up, at least, to the norm. It is just possible that you may be far better teachers due to having applied your methods to teaching yourselves than in merely studying how to teach others."

Following some such exhortation the students who needed it were given from 2 to 4 half-hour periods per week. They worked in groups of six to ten and, since attendance was voluntary, no record was kept. Students who came were watched for poor or bad habits of work and were helped. The "Economy Remedial Exercise Cards" of the Compass system were used extensively. Diagnostic tests were given to locate types of errors. Reference was constantly made to good habits of work and good learning technique. Practically all of this was extra-class work, class work being taken up with the professional aspects of arithmetic teaching.

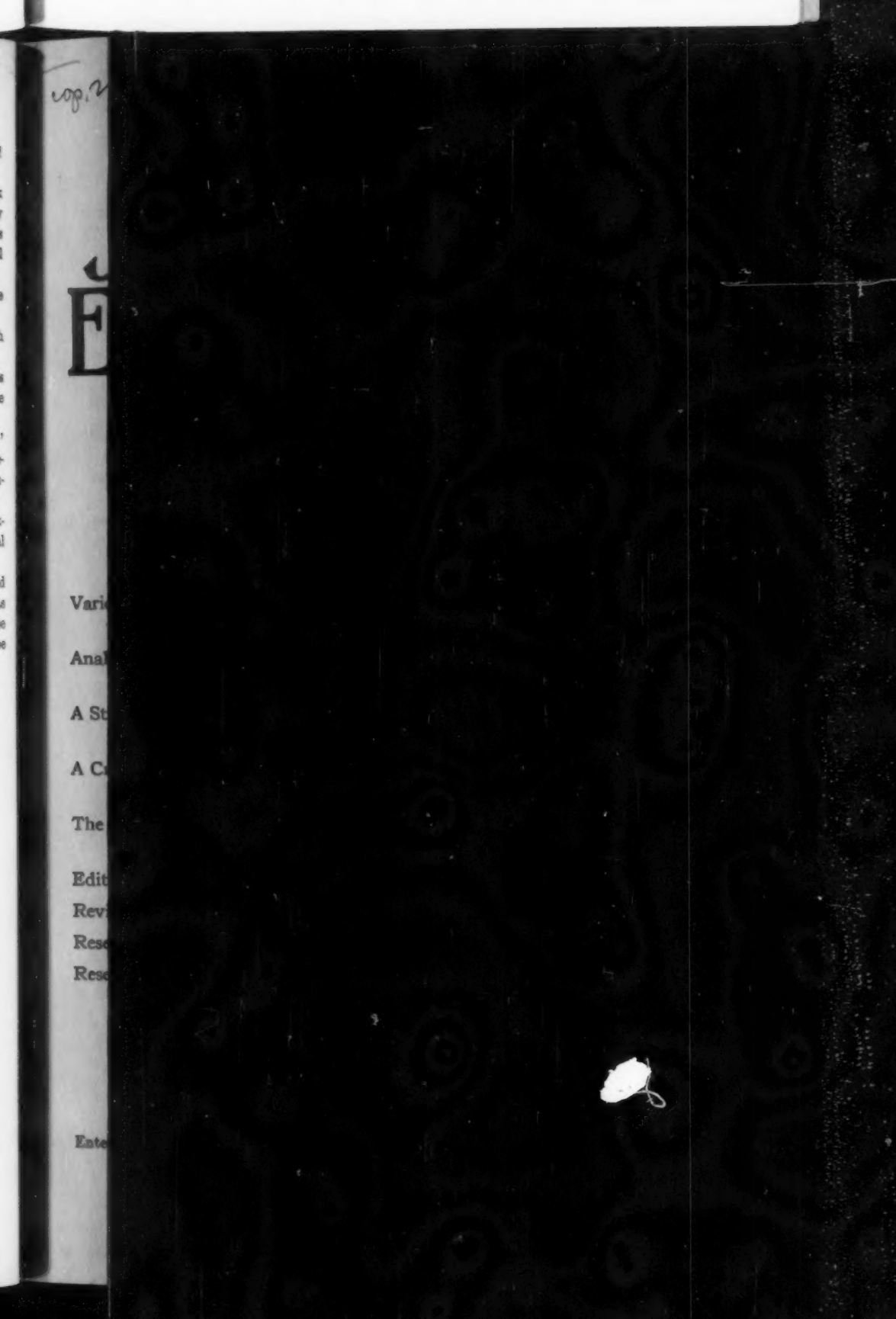
These results indicate several tentative conclusions:

1. College freshmen know little enough about arithmetic.

2. Such lack, with the present excess supply of teachers, serves as a remarkable incentive.

3. In most cases such "inabilities" are rather quickly corrected, because relearning under the stimulus of ideal conditions is rapid.

4. Rapid progress is tremendously satisfying and motivates the professional study.

5. Progress seems to be so rapid and to come as the result of so little effort as to indicate that no separate college course in mere arithmetic can possibly be justified.

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